•• REMARKS ••

The Official Action of December 12, 2002 has been thoroughly studied. Accordingly, the changes presented herein for the application, considered together with the following remarks, are believed to be sufficient to place the application into condition for allowance.

By the present amendment, independent claim 1 has been changed to recite that the thermoplastic synthetic resin film is substantially non-porous and moisture-pervious. Support for this limitation can be found on page 5, lines 13-14 of applicant's specification.

In addition, independent claim 1 has been changed to correct the typographical error noted by the Examiner in line 5 of the claim.

Also by the present amendment, new independent claim 9 has been added which recites a composite sheet formed from a thermoplastic synthetic resin fibrous sheet and a thermoplastic synthetic resin film which is bonded to the thermoplastic synthetic resin fibrous sheets to form a composite sheet having a substantially flat exposed surface defined by the thermoplastic synthetic resin film.

In addition, new independent claim 10 has been added which recites a composite sheet formed from a thermoplastic synthetic resin fibrous sheet and a thermoplastic synthetic resin film in which the thermoplastic synthetic resin film is imperforated.

Support for new claims 9 and 10 can be readily found in Fig. 2 which depicts the upper surface of the composite sheet as being substantially flat and imperforated.

Entry of the changes to the claims is respectfully requested.

Claims 1, 7 and 8 stand rejected under 35 U.S.C. §112, second paragraph. Under this rejection the Examiner has noted an inadvertent typographical error in line 5 of claim 1 that has been corrected by the present amendment.

With regard to claims 7 and 8, the Examiner noted that a JIS standard is recited which renders these claims indefinite.

The Examiner notes that the rejection based upon the recitation of the JIS standard can be overcome by submitting a copy of the testing method which can be placed in the application file.

In accordance with the Examiner's instructions, applicant is submitting herewith a copy of JIS L 1092 (Exhibit "A") together with an English language translation of this standard (Exhibit "B"). Also submitted is a copy of JIS L 1099 (Exhibit "C"). An English language translation of JIS L 1099 is being obtained and will be submitted to the Examiner in due course.

Claims 1-9 are pending in this application.

Claims 1, 4 and 5 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,976,665 to Hansson.

Claims 2 and 3 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hansson in view of U.S. Patent No. 6,025,049 to Ouellette et al.

Claims 1 and 4-8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hansson.

For the reasons set forth below, it is submitted that all of applicant's pending claims are allowable over the prior art of record and therefore, each of the outstanding rejections of the claims should properly be withdrawn.

Favorable reconsideration by the Examiner is earnestly solicited.

The Examiner has relied upon Hansson as disclosing a top sheet for absorbent articles that comprises a pervious thermoplastic film which is bonded to a nonwoven sheet. The Examiner notes that both layers may comprise thermoplastic materials and that the film is bonded to the nonwoven so as to form a plurality of parallel waves and toughs.

The liquid permeable casing sheet of Hansson includes a first layer 2 which is corrugated to form the "waves" and "troughs" relied upon by the Examiner. As discussed at column 2, lines 57-59, Hansson requires the first layer 2 to have "rows of openings 6, disposed in the crests of the parallel wave-shaped corrugations."

Although not specifically stated, one can conclude from the overall teachings of Hansson that the openings 6 are relied upon to limit the points of contact between the first layer 2 and the wearer's skin and to provide for ventilation. In any event, it is clear that the openings 6 are required by Hansson.

Applicant's thermoplastic synthetic resin film is substantially non-porous and moisture-pervious. Accordingly, it is applicant's claimed thermoplastic synthetic resin film excludes the openings 6 of Hansson which would make applicant's thermoplastic synthetic resin film porous rather than non-porous.

On page 3 of the Official Action the Examiner concedes that "Hansson....does not disclose the particular water-resistance and moisture permeability."

Nevertheless, the Examiner takes the position that:

> With regard to moisture permeability and water-resistance, either the material of Hansson would inherently posses these properties, or it would have been obvious to have optimized the moisture permeability and water resistance of the topsheet through the process of routine experimentation.

Applicant's independent claim 1 requires that the thermoplastic synthetic resin film is substantially non-porous. The openings 6 required by Hansson clearly render the first layer 2 would prevent the first layer from being non-porous.

Accordingly, Hansson does not teach inherently or otherwise, applicant's claimed invention.

It is further submitted that any modification of Hansson to "optimize the moisture permeability and water resistance of the topsheet through the process of routine experimentation" cannot be based upon, or directed by, applicant's own disclosure. That is, obviousness cannot be based upon modifying Hansson in view of applicant's disclosure as if applicant's own disclosure were available as a prior art reference.

Hansson does not teach applicant's water-resistance and moisture permeability as concede by the Examiner. It may be proper to modify Hansson as the Examiner suggests, but the Examiner is required to rely upon a teaching that provides the motivation or suggestion for any modification under 35 U.S.C. §103.

The Examiner's reliance upon Ouellette et al. does not address or overcome the differences between applicant's claimed invention and Hansson.

Based upon the above distinctions between the prior art relied upon by the Examiner and the present invention, and the overall teachings of prior art, properly considered as a whole, it is respectfully submitted that the Examiner cannot rely upon the prior art as required under 35 U.S.C. §102 as anticipating applicant's claimed invention. Moreover, the Examiner cannot properly rely upon the prior art under 35 U.S.C. §103 to establish a *prima facie* case of obviousness of applicants' claimed invention.

It is, therefore, submitted that any reliance upon prior art would be improper inasmuch as the prior art does not remotely anticipate, teach, suggest or render obvious the present invention.

It is submitted that the claims, as now amended, and the discussion contained herein clearly show that the claimed invention is novel and neither anticipated nor obvious over the teachings of the prior art and the outstanding rejection of the claims should hence be withdrawn.

Therefore, reconsideration and withdrawal of the outstanding rejection of the claims and an early allowance of the claims is believed to be in order.

It is believed that the above represents a complete response to the Official Action and reconsideration is requested.

If upon consideration of the above, the Examiner should feel that there remains outstanding issues in the present application that could be resolved, the Examiner is invited to contact applicants' patent counsel at the telephone number given below to discuss such issues.

To the extent necessary, a petition for an extension of time under 37 CFR §1.136 is hereby made. Please charge the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 12-2136 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Marked-Up Copy of the Claims
As Amended on March 11, 2003

1. (Twice Amended) A composite sheet comprising:

a substantially non-porous and moisture-pervious thermoplastic synthetic resin film having an upper and a lower surface;

a thermoplastic synthetic resin fibrous sheet bonded to at least one of the upper and lower surfaces of said thermoplastic synthetic resin film;

a plurality of [or] bulgy structural zones formed on a surface of the thermoplastic synthetic resin film that is opposed to said thermoplastic synthetic resin fibrous sheet, the plurality of bulgy structural zones extending in one direction in parallel and spaced apart from one another; and

substantially flat zones defined between adjacent ones of the bulgy structural zones,

said thermoplastic synthetic resin film being welded along said bulgy structural zones to said thermoplastic synthetic resin fibrous sheet.

New claims 9 and 10 were added as follows:

--9. (New) A composite sheet comprising:

a thermoplastic synthetic resin fibrous sheet;

a thermoplastic synthetic resin film bonded to the thermoplastic synthetic resin fibrous sheets to form a composite sheet having a substantially flat exposed surface defined by the thermoplastic synthetic resin film;

a plurality of bulgy structural zones formed on a surface of the thermoplastic synthetic resin film that is opposed to said thermoplastic synthetic resin fibrous sheet, the plurality of bulgy structural zones extending in one direction in parallel and spaced apart from one another; and

substantially flat zones defined between adjacent ones of the bulgy structural zones,

said thermoplastic synthetic resin film being welded along said bulgy structural zones to said thermoplastic synthetic resin fibrous sheet.--

--10. (New) A composite sheet comprising:

an imperforated thermoplastic synthetic resin film having an upper and a lower surface;

a thermoplastic synthetic resin fibrous sheet bonded to at least one of the upper and lower surfaces of said thermoplastic synthetic resin film;

a plurality of bulgy structural zones formed on a surface of the thermoplastic synthetic resin film that is opposed to said thermoplastic synthetic resin fibrous sheet, the plurality of bulgy structural zones extending in one direction in parallel and spaced apart from one another; and

substantially flat zones defined between adjacent ones of the bulgy structural zones,

said thermoplastic synthetic resin film being welded along said bulgy structural zones to said thermoplastic synthetic resin fibrous sheet.--

Exhibit A

JIS

JAPANESE INDUSTRIAL STANDARD

Translated and Published by
Japanese Standards Association

JIS L 1092 : 1998

Testing methods for water resistance of textiles

ICS 59.080.01

Descriptors : textile products, cloth, water-resistance tests, waterproof materials

Reference number : JIS L 1092 : 1998 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS L 1092** : 1992 is replaced with **JIS L 1092** : 1998.

Date of Establishment: 1977-03-01

Date of Revision: 1998-06-20

Date of Public Notice in Official Gazette: 1998-06-22

Investigated by: Japanese Industrial Standards Committee
Divisional Council on Consumer Life

JIS L 1092:1998, First English edition published in 1999-04

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents, the original JIS is to be the final authority.

Printed in Japan

Testing methods for water resistance of textiles

Introduction This Japanese Industrial Standard was made on the basis of **ISO 811**, *Textile fabrics—Determination of resistance to water penetration—Hydrostatic pressure test* published in 1981 as the first edition, **ISO 4920**, *Textiles—Determination of resistance to surface wetting (spray test) of fabrics* published in 1981 as the first edition and **ISO 9865**, *Textiles—Determination of water repellency of fabrics by the Bundesmann rain-shower test* published in 1991 as the first edition without changing the technical contents with the exception of the following items added.

a) Definitions, sampling of test specimens and conditioning specified conventionally in the Japanese Industrial Standard were added.

b) B method of the water penetration test (hydrostatic pressure method, constant hydraulic pressure method and water leakage method) specified conventionally in the Japanese Industrial Standard was added.

c) A method of the water penetration test (constant hydraulic pressure method and water leakage method) and B method of the rain test specified conventionally in the Japanese Industrial Standard were also added.

1 Scope This Japanese Industrial Standard specifies the testing methods for water resistance of textiles.

Remarks 1 Water resistance is a generic term of water proofing, resistance to surface wetting, water leakage, etc.

2 The following standards are the corresponding International Standards to this Standard:

ISO 811 : 1981	*Textile fabrics—Determination of resistance to water penetration—Hydrostatic pressure test*
ISO 4920 : 1981	*Textiles—Determination of resistance to surface wetting (spray test) of fabrics*
ISO 9865 : 1991	*Textiles—Determination of water repellency of fabrics by the Bundesmann rain-shower test*

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The latest editions of them apply.

JIS K 0117	*General rules for infrared spectrophotometric analysis*
JIS K 1521	*Perchloroethylene*
JIS K 2246	*Rust preventive oils*
JIS K 8322	*Chloroform*
JIS K 8848	*Hexane*
JIS K 8858	*Benzene*
JIS K 8891	*Methanol*

JIS L 0105 *General principles of physical testing methods for textiles*

JIS L 0217 *Care labelling of textile goods*

JIS L 0803 *Standard adjacent fabrics for staining of colour fastness test*

JIS L 1096 *Testing methods for woven fabrics*

JIS P 3801 *Filter paper (for chemical analysis)*

JIS R 3503 *Glass apparatus for chemical analysis*

JIS Z 8806 *Humidity – Measurement methods*

3 Definitions For the purpose of this Standard the following definitions apply:

a) **standard condition of laboratory** The condition that the temperature, humidity and the tolerance on them in laboratory are the temperature of (20±2) ℃ and the relative humidity of (65±2) % which are specified in **JIS L 0105**.

Remarks: Use a Meteorological Agency type or Assmann's aspiration psychrometer as specified in **JIS Z 8806** to determine the temperature and use the humidity table by Sprung's formula to determine the relative humidity.

b) **standard condition of test specimen** The condition under which the test specimens are allowed to stand and come to a constant weight.

c) **constant weight** The mass of the test specimen when weighed at intervals not shorter than one hour and thus obtained difference between two measurements has come to within 0.1 % of the mass at the latter measurement.

4 Classification of tests The tests shall be classified as shown below:

a) **Test for water penetration (Hydrostatic pressure method)** This test applies mainly to textile fabrics with no air permeability.

1) Method A (Low hydraulic pressure method)

2) Method B (High hydraulic pressure method) (1)

Note (1) This method usually applies to the test specimens which can be tested by applying a hydraulic pressure exceeding 10 kPa.

b) **Test for resistance to surface wetting (Spray method)** This test applies to textile fabrics with air permeability.

c) **Rain test (Shower test) method A**

5 Sampling and conditioning of test specimens

5.1 Sampling and preparation of test specimens The test specimens shall be sampled at random from the area distant $\frac{1}{10}$ of width from both selvages and not less than 1 m from the end in the case of woven fabric or kilted fabric while, in the case of product, be sampled from the front cloth of the fabric, and they shall be brought to standard condition.

Remarks: If it is impossible to keep the laboratory at standard condition, place the test specimen in a closed container (containing 36 % sulfuric acid) maintained at (20±2) ℃ and bring to a constant weight.

5.2 Conditioning of test specimens If necessary, carry out the following conditionings on the test specimens specified in **5.1** separately or in combination and then carry out the tests specified in **6.**

Remarks: The waterproof retention of the conditioned test specimens shall be calculated by the following formula down to one decimal place after testing the test specimen before conditioning and after conditioning in accordance with the methods specified in **6.**

$$\text{Waterproof retention } (\%) = \frac{A}{A_0} \times 100$$

where, A_0: test value of non-conditioned test specimen

A: test value of conditioned test specimen

a) **Laundry treatment** One of the following methods is used:

1) **Method A** (method to use a stirring type washing machine) Use the method specified in **6.23.1** of **JIS L 1096** and use drip dry as drying method.

2) **Method B** (method to use a cylinder type washing machine) Use the method specified in **6.23.2** of **JIS L 1096.**

3) **Method C** (method to use an electric washing machine for domestic use) Use the method specified in No. 103 of Attached Table 1 of **JIS L 0217.**

b) **Dry cleaning treatment** Put approximately 3.78 *l* of perchloroethylene (²) at approximately 30 ℃ in the cylinder of wash cylinder type washer as shown in Fig. 1, insert an approximately 50 cm × 50 cm test specimen and a load cloth (³) adjusted to become approximately 0.45 kg in their combined weight and operate the washer for 10 minutes.

Dehydration is carried out by a centrifuge until almost all water is removed. If it is impossible to do so, press lightly to remove water, place between filter papers or cloth and press again to remove the water. Do not use a mangle to squeeze.

Dry using any one selected from among the following four methods:

Notes (²) The perchloroethylene is as specified in **JIS K 1521.**

(³) The cotton cloth (standard adjacent fabric for staining No. 3) specified in **JIS L 0803** whose edges are hemmed and size is the same as the test specimen is used.

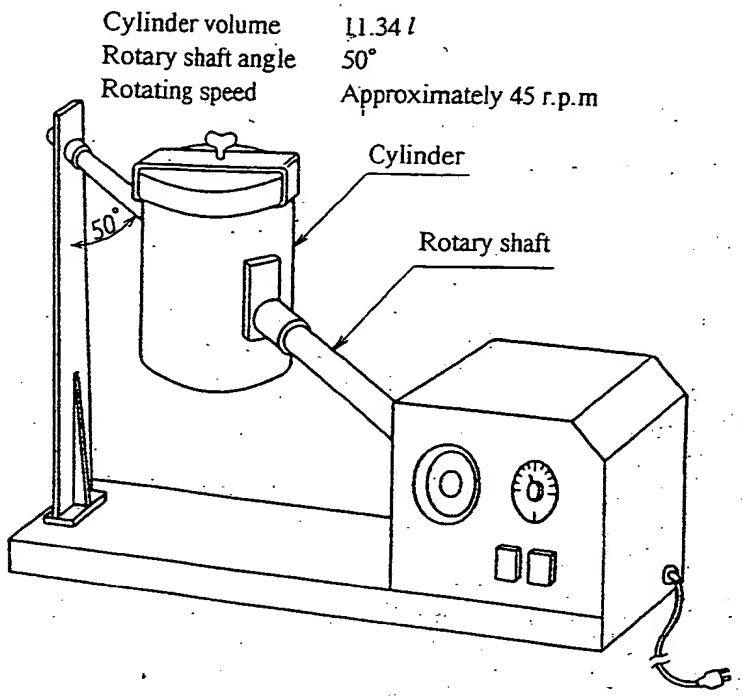


Fig. 1 Wash cylinder type washer

1) **Screen drying** After centrifuging, dry the test specimen by smoothing unnatural wrinkles without twisting or elongating, and spreading on a flat screen mesh or a surface drilled with similar holes. Natural drying shall be used. In order to enhance the efficiency of the test, it may be dried in a dryer at not higher than 70 ℃.

2) **Line drying** After centrifuging, grip two corners so that the warp or the wale direction is vertical and dry by suspending in a place without ventilation at room temperature.

Remarks: Line drying should not be used for fabrics likely to be elongated easily in the wale direction.

3) **Drip drying** Without centrifuging the test specimen, grip two corners so that the warp or the wale direction is vertical and dry by suspending in a place without ventilation at room temperature.

Remarks: Drip drying is used for wash and wear fabrics.

4) **Tumble drying** After centrifuging, put in a tumble dryer and operate at the temperature of 50 ℃ to 70 ℃ for 30 minutes or until the test specimen dries.

c) **Weathering treatment** Perform the method specified in **5.36** of **JIS K 2246**. The time taken for one time of treatment shall be 20 hours.

6 Testing methods

6.1 Test for water penetration (Hydrostatic pressure method) The test shall be carried out by the hydrostatic pressure method in accordance with the following method A (Low

hydraulic pressure) or method B (High hydraulic pressure method).

In addition to the hydrostatic pressure method, the constant hydraulic pressure method or water leakage method specified in Annex 1 may be used.

a) Method A (Low hydraulic pressure method) is as follows:

1) **Apparatus and material** The following apparatus and material shall be used:

1.1) **Water penetration test apparatus (for low hydraulic pressure)** The apparatus shown in Fig. 2 or those equivalent thereto whose rate of increase of water pressure is (60±3) cm/min and (10±0.5) cm/min. The clamp shall be of such size that the part of the test specimen which touches the water is 100 cm^2.

1.2) **Hydraulic pressure gauge (manometer)** With 0.5 cm scale and of approximately 1 m or higher in the maximum water level when raising the water levelling apparatus.

1.3) **Water** The distilled or ion-exchange water maintained at (20±2)℃ in the test shall be used and the chosen alternative shall be stated in the test report.

Informative reference: Water temperature influences sometimes the test result.

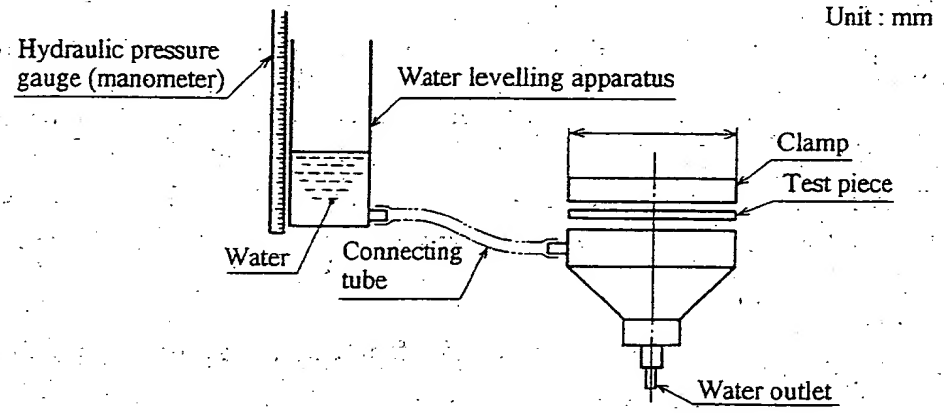


Fig. 2 Water penetration test apparatus (for low hydraulic pressure)

2) **Procedure** From the test specimens specified in **5**, sample test pieces each measuring approximately 15 cm × 15 cm, take five sheets of them for the following each test, mount the test pieces on the water penetration test apparatus shown in Fig. 2 in such a way that the front surface (*) touches the water, raise the water level by raising the water levelling apparatus containing water at a speed of (60±3) cm/min or (10±0.5) cm/min and measure the water level to an accuracy of cm at the time when the water comes out from three places on the reverse surface of the test pieces. The accuracy of the water level to be reported is

− less than 1 m: 0.5 cm

− from 1 m and less than 2 m: 1.0 cm

− 2 m or more: 2.0 cm

Each result of five test pieces and the average value shall be expressed down to first decimal place. If the water does not come out from three places even when the water

level is raised, measure the water level at the time when the water comes out from one or two places and state that effect in the test report.

The extremely small water drops which do not grow after being formed and the waterdrops formed by penetrating through the same place shall be ignored.

Note (4) The front surface is the waterproofed surface or the surface the water touches at the time of use.

Informative reference: The test for water penetration, method A (Low hydraulic pressure method) is the same test method as that in **ISO 811**.

b) Method B (High hydraulic pressure method) is as follows:

1) **Apparatus and material** The following apparatus and material shall be used:

1.1) **Water penetration test apparatus (for high hydraulic pressure)** The apparatus shown in Fig. 3 or those equivalent thereto whose rate of increase of water pressure is 100 kPa per minute.

1.2) **Water** The distilled or ion-exchange water maintained at (20±2) ℃ in the test shall be used and the chosen alternative shall be stated in the test report.

2) **Procedure** From the test specimens specified in **5**, sample the test pieces each measuring approximately 15 cm × 15 cm, take five sheets of them for the following each test, mount the test pieces on the water penetration test apparatus shown in Fig. 3 in such a way that the front surface (4) touches the water, fill the cylinder with water, turn the piston handle to apply hydraulic pressure at a rate of 100 kPa per minute and measure the water pressure (kPa) to an accuracy of $\frac{1}{2}$ of the scale of the pressure indicator at the time when the water comes out from three places on the reverse surface of the test pieces.

The average value of five measurements shall be expressed down to first decimal place. If the water does not come out from three places even when the hydraulic pressure is raised, measure the water level at the time when the water comes out from one or two places and state that effect in the test report.

The extremely small water drops which do not grow after being formed and the waterdrops formed by penetrating through the same place shall be ignored.

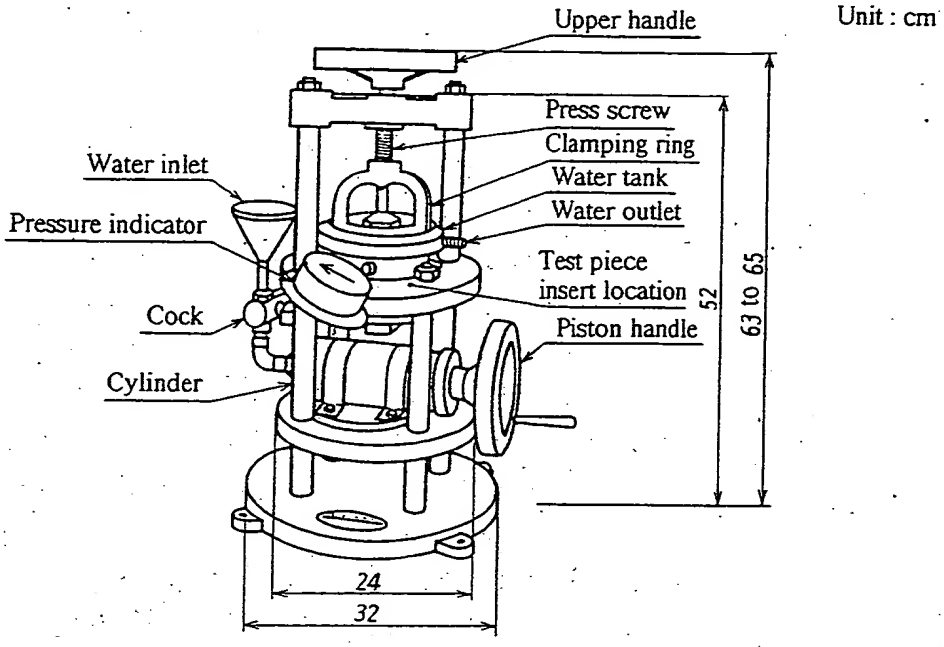


Fig. 3 Water penetration test apparatus (for high hydraulic pressure)

6.2 Test for resistance to surface wetting (Spray test) The test for resistance to surface wetting shall be as follows :

a) **Apparatus and material** The following apparatus and material shall be used :

1) **Apparatus for test for resistance to surface wetting** The apparatus shown in Fig. 4 or those equivalent thereto with the glass funnel of 250 ml or larger in volume and the spray nozzle capable of spraying 250 ml of water in 20 seconds to 30 seconds.

2) **Test piece holder** The metal holder of 150 mm diameter or that equivalent thereto.

3) **Comparison examples for wetting condition** The examples to which the rating number is given according to the wetting conditions as shown in Fig. 5.

4) **Water** The distilled or ion-exchange water maintained at (20±2) ℃ in the test shall be used and the chosen alternative shall be stated in the test report.

b) **Procedure** From the test specimens specified in **5**, sample three sheets of test pieces measuring approximately 20 cm × 20 cm, mount a test piece on the holder without creasing, make the center of spray coincide with the center of the test piece holder using the apparatus for the test of resistance (see Fig. 4) to surface wetting so that the warp direction of the test piece is parallel to the flow of water down. Pour 250 ml of water into the glass funnel to spray on the test piece within 25 seconds to 30 seconds.

Remove the holder from the stand, hold horizontally with its one end, face the front surface of the test piece downward, tap another end against a solid object, turn by 180° and repeat the same procedure as before to drop the excessive water drops. Compare the wetting condition of the test piece as attached to the holder with the comparison example for wetting condition specified in Fig. 5 to assess. No middle rating is taken.

Informative reference: The test for the resistance to surface wetting (Spray test) is the same test method as specified in **ISO 4920**.

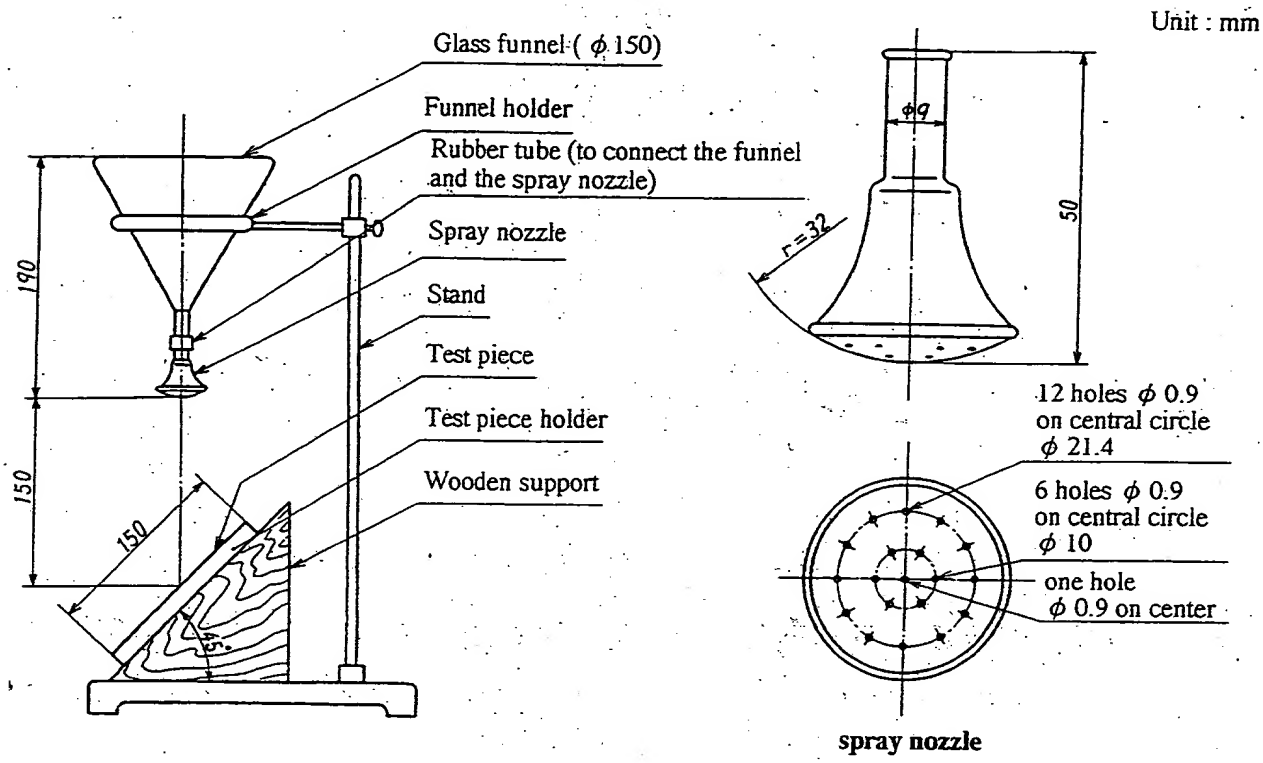
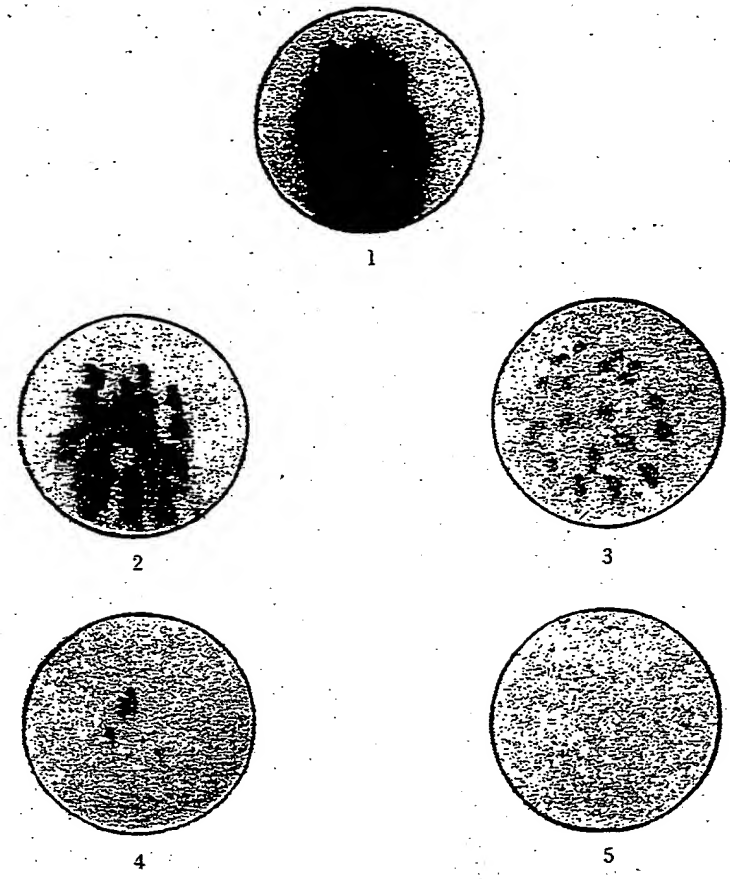


Fig. 4 Apparatus for the test of resistance to surface wetting



1: Complete wetting of whole upper surface.

2: Half wetting of whole of upper surface and small individual wetting of penetrating the cloth.

3: Wetting of upper surface at small spray points.

4: Slight random sticking or wetting of upper surface.

5: No sticking or wetting of upper surface.

Fig. 5 Comparison sample of wetting condition

6.3 Rain test (Shower test) method A The rain test method A shall be as follows: In addition to the method A, the method B specified in Annex 1 may be used.

a) **Apparatus and material** The apparatus and material shall be as follows:

1) **Bundesman rain-shower test apparatus** The apparatus shown in Fig. 6 or those equivalent thereto which consist of rain shower equipment and testing device. The rain shower equipment comprising a system of about 300 identical drop-forming nozzles (nozzle of 4 mm diameter to produce a waterdrop of approximately 0.07 ml) over a circular surface (area of approximately 1 300 cm^2) of 406 mm diameter shall be capable of producing a rain shower of the flow rate of (100±5) ml/min per 100 cm^2.

The testing device shall be so constracted that four cups are mounted on the stand for the centerline of the cup to be inclined at 15° from the vertical and the stand rotates

approximately six turns in one minute. Each test cup, the outer diameter of which is 100 mm, enables the specimen (tested area of 80 cm^2) to be mounted on the upper part by means of a test piece clamping ring and the water passing through the test piece to be collected in the cup. In addition, each cup comprises a polished stainless steel wiper of 48 mm in length (Informative reference: Curved slightly to the top in the longitudinal direction with radius of curvature 630 mm), 5 mm in width and 5 mm in radius of rounded scraper edge. The wiper is pressed against the underside of the test piece during testing with force of 2.5 N to describe 20 reciprocating rotary movements per minute at an angle of 100°. The distance between the waterdrop-forming nozzle of rain shower equipment and the center of the test piece mounted on the testing device shall be 1 500 mm.

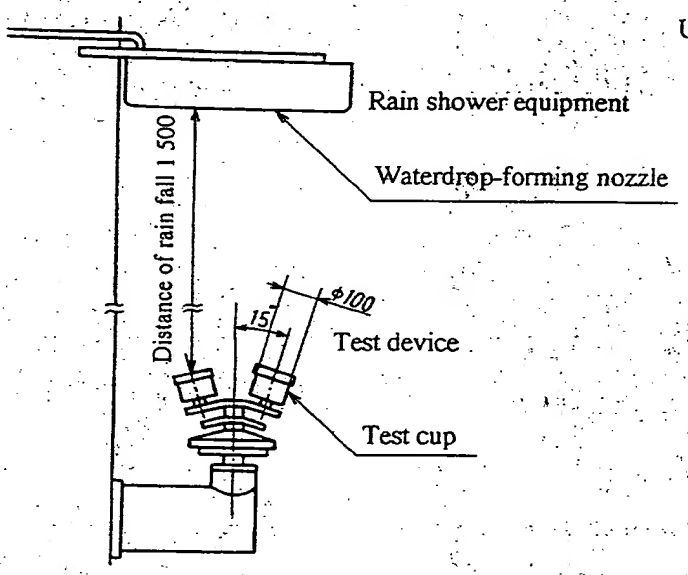
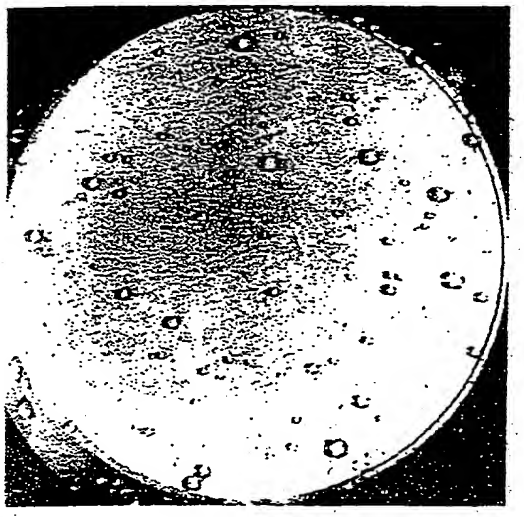


Fig. 6 Bundesmann rain-shower test apparatus

2) **Comparison samples for wetting condition** The reference samples specifying the assessment according to the wetting conditions as illustrated in Fig. 7.



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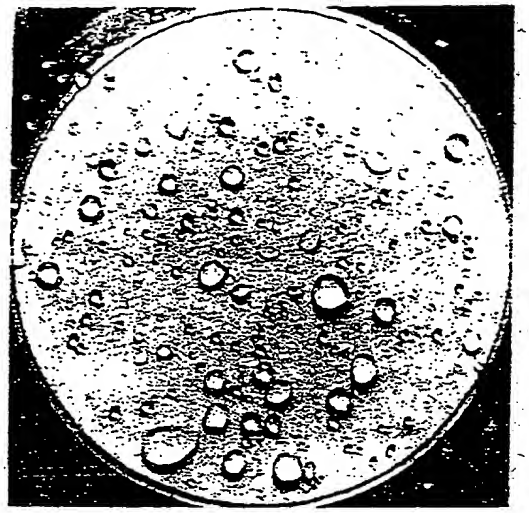

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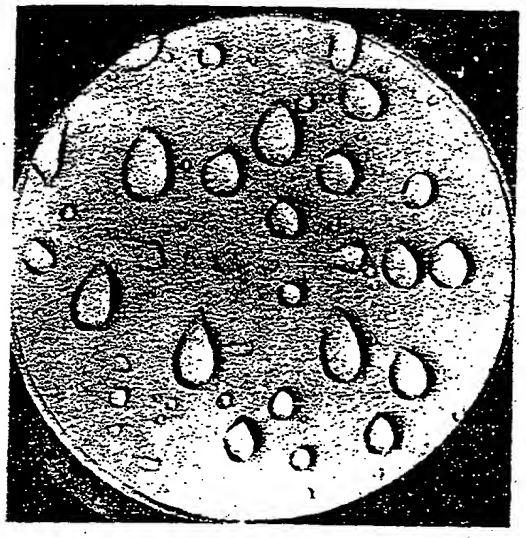

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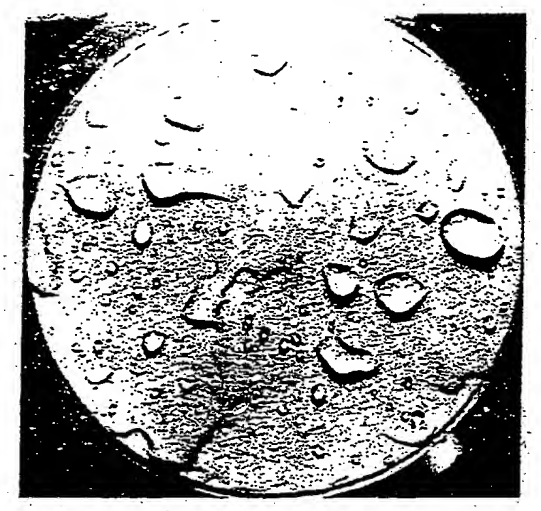

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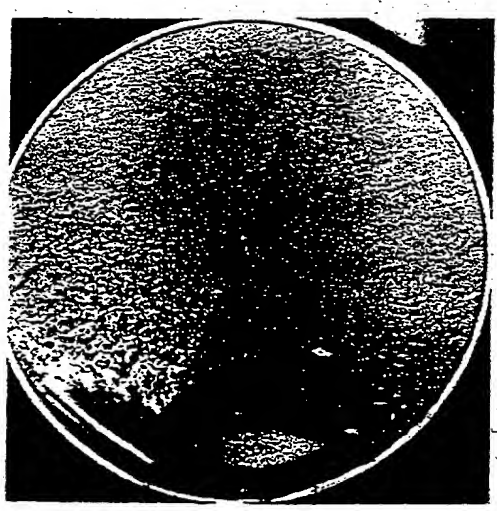


Grade 1

Fig. 7 Refernce photographs for comparison of wetting condition

3) **Centrifuge** Comprising a disc with a horizontal test piece mounting surface of diameter 175 mm rotating at 700 rpm (the time required to attain this speed is between 1 s and 2 s). The total mass of the rotating part shall be 410 g. On the test piece mounting surface, approximately 50 ribs (1 mm in height) are provided in a radial arrangement, and four steel pins of 6 mm long spaced 60 mm away from the center of the rotary axis are provided in an equally spaced arrangement to secure the test pieces.

4) **Balance** Capable of weighing to an accuracy of 0.01 g.

5) **Water** Temperature of (20±3) ℃. Temperature, hardness and pH during the test shall be recorded.

b) **Preparation of rain-shower** After checking each part of the test apparatus, switch on the rain shower equipment for approximately 15 minutes to set the rain flow control valve of the rain shower equipment so that (200 ±10) ml of water is collected in each cup after 2.5 minutes.

c) **Procedure** From the specimens specified in 5, sample four sheets of circular test pieces of 140 mm diameter, weigh their mass to an accuracy of 0.01 g, mount on the test cups and start the operation after fixing them on the stand of the test device. After exposing the test pieces to the rain-shower for 10 minutes (rain falling time may be 1 min or 5 min), stop rain falling. Assess the wetting condition of upper surface of the test pieces by visual comparison with the reference samples, remove the test pieces from the cups, mount on the centrifuge, operate for 15 seconds to remove the excessive drops on the test pieces and weigh immediately the mass to an accuracy of 0.01 g. Then measure the volume of the water which has passed through the test pieces and is collected in the cups to determine the leakage (ml).

The test results shall be expressed, by calculating the amount of water absorption (g) and the rate of water absorption (%) by the following formulas, with the average of four sheets to the integer place for the water repellency, down to two decimal places for the amount of water absorption and down to one decimal place for the rate of water absorption.

$$\text{Amount of water absorption (g)} = M - M_0$$

$$\text{Rate of water absorption (\%)} = \frac{M - M_0}{M_0} \times 100$$

where M_0: mass of test pieces before the test (g)

M: mass of test pieces after the test (g)

Informative reference: The rain test (Shower test) is the same test method as that in **ISO 9865**

7 **Test report** The test report shall include the following information. If the conditioning of specimen specified in 5.2 is carried out, the method of conditioning, number of times of conditioning and circumstances at the time of conditioning shall be stated as well.

a) **Test for water penetration (Hydrostatic pressure method)**

1) Classification of test

2) Measured values: water level (method A) or water pressure (method B) when water comes out from three places

b) **Test for resistance to surface wetting (Spray test)** Result of assessment of each test specimen

c) **Rain test (Shower test) method A**

1) Amount of water absorption and rate of water absorption

2) Wetting condition of surface

3) Water leakage

4) Temperature, hardness and pH of the water used for the shower

5) Amount of rain fall and time of rain falling, where appropriate

Annex 1 (normative) Testing methods for water resistance

1 Scope This Annex specifies the test for water penetration based on constant hydraulic pressure method or water leakage method and the rain test method B which have been specified conventionally in the Japanese Industrial Standard.

2 Classification of tests The tests shall be classified as given in the following:

a) **Test for water penetration (Constant hydraulic pressure method or Water leakage method)** This test applies mainly to textile fabrics with no air permeability.

1) Method A (Low hydraulic pressure method)

2) Method B (High hydraulic pressure method) (1)

Note (1) Usually, this test applies to the specimens capable of being tested applying hydraulic pressure of 10 kPa or higher.

b) **Rain test (Shower test) method B**

3 Test methods

3.1 Test for water penetration (Constant hydraulic pressure method or Water leakage method) The test shall be carried out by the constant hydraulic pressure method or the water leakage method in accordance with Method A (Low hydraulic pressure method) or Method B (High hydraulic pressure method).

a) Method A (Low hydraulic pressure method) shall be as follows:

1) **Apparatus and material** The following apparatus and material shall be used:

1.1) **Apparatus for water penetration test (for low hydraulic pressure)** The same apparatus as in **6.1 a) 1.1)** in the body.

1.2) **Hydraulic pressure gauge (manometer)** The same gauge as in **6.1 a) 1.2)** of the body.

1.3) **Stopwatch** With a 0.5 s scale.

1.4) **Measuring cylinder** With a 1 ml scale.

1.5) **Water** Distilled or ion-exchange water maintained at (20±2) ℃ in the test shall be used and the chosen alternative shall be stated in the test report.

2) **Procedure** From the test specimens specified in **5**, sample the test pieces each measuring approximately 15 cm × 15 cm, take five sheets of them for the following each test, mount the test pieces on the apparatus for water penetration test (for low hydraulic pressure) in such a way that the front surface (2) touches the water, raise the water levelling device filled with water at a rate of (60±3) cm/min or (10±0.5)

cm/min, obtain the resistance to water penetration by either of the following methods and express the average value of five measurements down to one decimal place. In this case, the method used shall be stated.

Note (^{2}) Front surface is the waterproofed surface or the surface the water touches at the time of the use.

2.1) **Constant hydraulic pressure method** When the water is raised to a given level and allowed to stand as it is, the time required until the water comes out from the reverse side of the test piece at three places is measured to an accuracy of 0.5 s. In the test result, the given water level shall be stated. If the water does not come out at three places, the time required until the water comes out at one place or two places is measured or the measurement is made by changing the water level higher. The change of water level shall be also stated in the report.

The extremely small waterdrops which do not grow after being formed shall be ignored.

2.2) **Water leakage method** After raising the water level up to a given level, the volume (ml) of the water passing through the test piece is measured after the given time has passed by putting in a measuring cylinder. The volume per unit area (cm^2) is expressed. In the test result, the given water level and the given time shall be stated.

b) Method B (High hydraulic pressure method) shall be as follows:

1) **Apparatus and material** The following apparatus and material shall be used.

1.1) **Apparatus for water penetration test (for high hydraulic pressure)** The equivalent of the apparatus in **6.1 b) 1.1)** of the body.

1.2) **Stopwatch** With a 0.5 s scale.

1.3) **Measuring cylinder** With a 1 ml scale.

1.4) **Water** Distilled or ion-exchange water maintained at (20±2) ℃ in the test shall be used and the chosen alternative shall be stated in the test report.

2) **Procedure** From the test specimens specified in 5, sample the test pieces each measuring approximately 15 cm×15 cm, take five sheets of them for the following each test, mount them on the apparatus for water penetration test (for high hydraulic pressure) in such a way that the front surface (^{2}) touches the water, fill the cylinder with water, turn the piston handle to apply hydraulic pressure at a rate of 100 kPa per minute, obtain the resistance to water penetration by the following each method and express the average value of five measurements down to one decimal place. In this case, the method used shall be stated.

2.1) **Constant hydraulic pressure method** When a given hydraulic pressure is applied and allowed to stand as it is, the time required until the water comes out from the reverse surface of the test piece at three places is measured (to an accuracy of 0.5 s). In the test result, the given hydraulic pressure (kPa) shall be stated. If the water does

not come out at three places, the time required until the water comes out at one place or two places is measured or the measurement is made by changing the hydraulic pressure higher. The change of the hydraulic pressure shall be stated in the report.

The extremely small waterdrops which do not grow after being formed shall be ignored.

2. 2) **Water leakage method** After applying a given hydraulic pressure, the water which has passed through the test piece is collected in a measuring cylinder after the given time and its volume (ml) is measured to be expressed down to one decimal place per unit area (cm^2). In the test result, the given hydraulic pressure (kPa) and the given time shall be stated.

3. 2 Rain test (Shower test) method B

Remarks: In this test, the resistance to surface wetting of test piece can be obtained in accordance with **6.2** of the body.

a) **Apparatus and material** The following apparatus and material shall be used.

1) **Apparatus for artificial rain test** The apparatus shown in Fig. 6 of the body.

2) **Rain quantity gauge** Capable of measuring the quantity of rain.

3) **Filter paper** Use circular filter paper (15 cm in diameter) of class 2 specified in **JIS P 3801**.

4) **Carpet** Capable of preventing water from splashing at the time of rain falling.

5) **Balance** Capable of weighing to an accuracy of 0.1 g.

6) **Water** Distilled or ion-exchange water maintained at (20±2) ℃ in the test shall be used and the chosen alternative shall be stated in the test report.

b) **Procedure** Using the apparatus for artificial rain fall test shown in Annex 1 Fig. 1, select the amount of water supply of the artificial rain fall apparatus and the position where the test piece hold is set so that, when the rain falls on the rain gauge placed on the carpet, the amount of the rain becomes 6 mm/h to 8 mm/h ([3]).

From the specimens specified in 5, sample three sheets of the test pieces each measuring approximately 20 cm × 20 cm, attach one sheet of the filter papers for water absorption of the known mass weighed to an accuracy of 0.1 g to the reverse side of each test piece to mount the test piece on the test piece holder, set them in the place where the artificial rain fall apparatus is put and allow the rain to fall for five minutes ([4]). When the rain falls, immediately take the filter paper away to weigh its mass, calculate the permeation quantity ([5]) by the following formula and express the average value of three measurements down to two decimal places. The chosen alternative in the amount of rain fall and the time of rain fall shall be stated in the test report.

$$\text{Permeation quantity (g)} = M - M_0$$

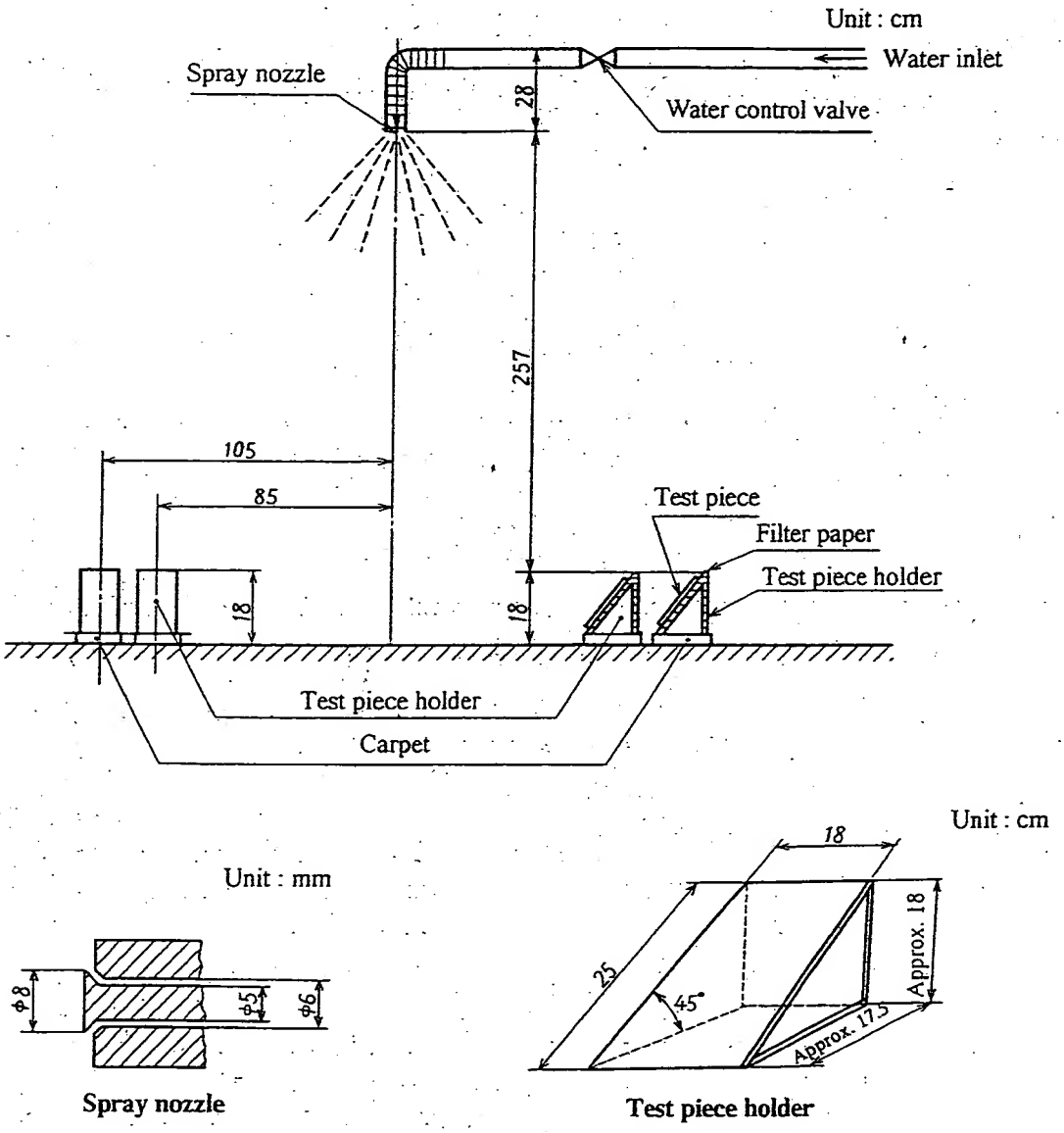
where, M_0: mass of filter paper before the test (g)

M: mass of filter paper after the test (g)

Notes ([3]) The amount of rainfall of 6 mm/h to 8 mm/h is the amount of ordinary rainfall. When testing in an area of heavy rainfall, increase the amount of rain to 10 mm/h to 15 mm/h.

([4]) When testing umbrella cloth, etc., increase the time of rainfall to 15 minutes.

([5]) When the permeation quantity comes to 5 g or more, stop the test and retest by changing the amount of rainfall and the time of rainfall.



Annex 1 Fig. 1 Apparatus for artificial rain fall test

4 Test report The test report shall include the following information for each type of the tests. If the conditioning of specimens specified in 5.2 of the body is carried out, the method of treatment and the number of times of the treatment carried out and the condition at the time of treatment shall be recorded.

a) **Test for water penetration**

1) Type of test

2) Measured values

Water level (Method A) or hydraulic pressure (Method B) at the time of water flow from three places

b) **Rain test (Shower test) method B**

1) Permeation quantity

2) As required, amount of rainfall, time of rainfall and number of times of rainfall

Annex 2 (informative) Determination of waterproofing agents

1 Scope This Annex specifies the determination of waterproofing agents used on waterproofed fabrics by infrared spectrophotometric analysis.

Remarks: Waterproofing agents to be subjected to the determination as given in this Annex are shown in Annex 2 Table 1. Depending on the operation of this Annex, processing agents used for the purposes other than waterproofing may also be detected.

Annex 2 Table 1 Classification of waterproofing agents and extraction solvents

In the Table, ○ indicates capable of extraction, △ indicates capable of extraction depending on the kind of fiber, and × indicates incapable of extraction.

Extraction solvent	Processing agents for non-aeration waterproofing (for coating work)						Processing agents for aeration waterproofing (for water repellent finishing)					
	Rubbers (1)	Polyvinylidene chlorides	Polyvinyl chlorides	Polyethylenes	Polyvinyl acetates	Polyurethanes	Paraffins	Ethylene ureas	Melamines	Methylolamides	Silicons	Fluorines
Methanol	×	×	×	×	○	△	△	○	○	○	△	×
Benzene (2)	○	○	○	○	○	○	○	×	×	×	○	△
Trichlorotrifluoroethane	×	×	△	×	△	×	△	×	×	△	△	○

Notes (1) Types of rubber include isoprenes, butadianes, styrenebutadienes, chloroprenes, acrylonitrile-butadienes, and natural rubbers (isoprene).

(2) When extracting by benzene, acetate fibers are dissolved and interfere with the test, and shall be, therefore, separated by column chromatography, etc.

2 Apparatus An infrared spectrophotometer satisfying the performance requirements specified in **JIS K 0117** shall be used.

3 Procedure

3.1 Extraction Prepare a test piece of approximately 5 g from the specimen, place it in a 200 ml round bottom flask with a reflux condenser, and add 150 ml of extraction solvent (3).

Extract for 1 h by heating to the boiling point of the extraction solvent, and filter the extracted liquid while warm using a sintered-glass filter (4). Put into a 200 ml egg-apple type flask, and concentrate using a rotary evaporator until the extracted liquid becomes 2 ml to 3 ml.

Notes (3) For extraction solvent, use benzene as specified in **JIS K 8858**, methanol as specified in **JIS K 8891**, or 1, 1, 2-trichloro-1, 2, 2-trifluoroethane (refer to the Annex 2 Table 1).

(4) The sintered-glass filter is as given in **JIS R 3503**, and the glass filter plate is that of fine pore symbol 2.

3.2 **Refining** Fill glass wool into a column chromatography tube of 10 mm to 15 mm in inside diameter and 200 mm to 300 mm in length, and fill the mixture of hexane (6) in column chromatography silica gel (5) until it reaches approximately 150 mm in height. Add in this the extracted liquid concentrated as given in **3.1**, and titrate approximately 100 ml of hexane (6), chloroform (7), and methanol, in that order, into the column chromatography tube. Receive the liquid passed through the chromatography tube for each solvent in a 100 ml egg-apple type flask (8) and remove by fractionating using a rotary evaporator.

Notes (5) Use silica gel of 40 mesh to 80 mesh. To achieve a height of approximately 15 cm, approximately 5 g of silica gel is required for an inner diameter of 10 mm, and approximately 10 g of silica gel is required for an inner diameter of 15 mm.

(6) Use hexane as specified in **JIS K 8848**.

(7) Use chloroform as specified in **JIS K 8322**.

(8) If qualitative determination as given in **3.3** is difficult, reperform the procedure of **3.1**, and separate the mixture by finely fractionating the same solvent in **3.2**.

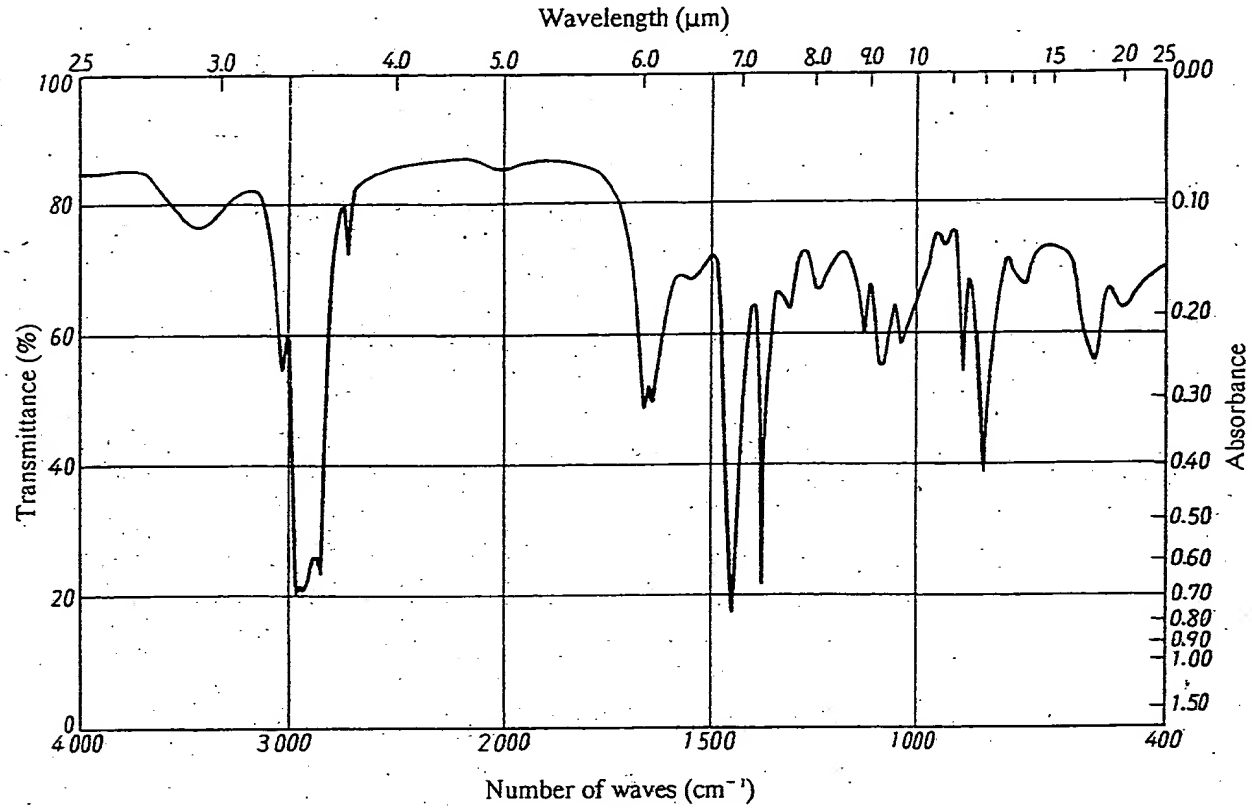
3.3 **Determination** Prepare the extracts refined in **3.2**, using potassium bromide tablets for solid extract, and using thin film for viscous extract, and measure the infrared absorption spectrum as given in **JIS K 0117**. Determine by comparison with the standard waterproofing agent spectral diagrams previously prepared. Examples of spectral diagrams obtained using the tablet method of potassium bromide are provided in Annex 2 Figs. 1 to 12.

4 **Test report** The test report shall include the following information:

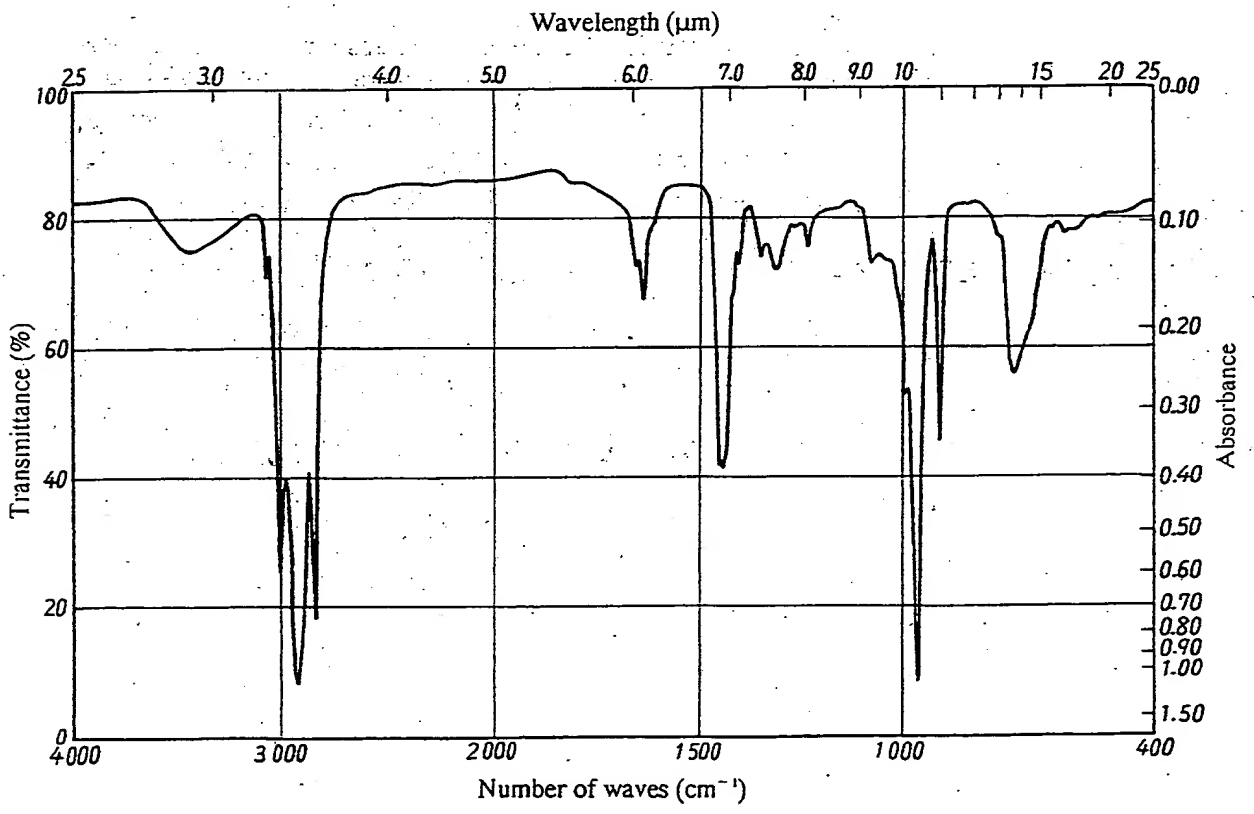
a) Result of determination

b) Extraction solvent

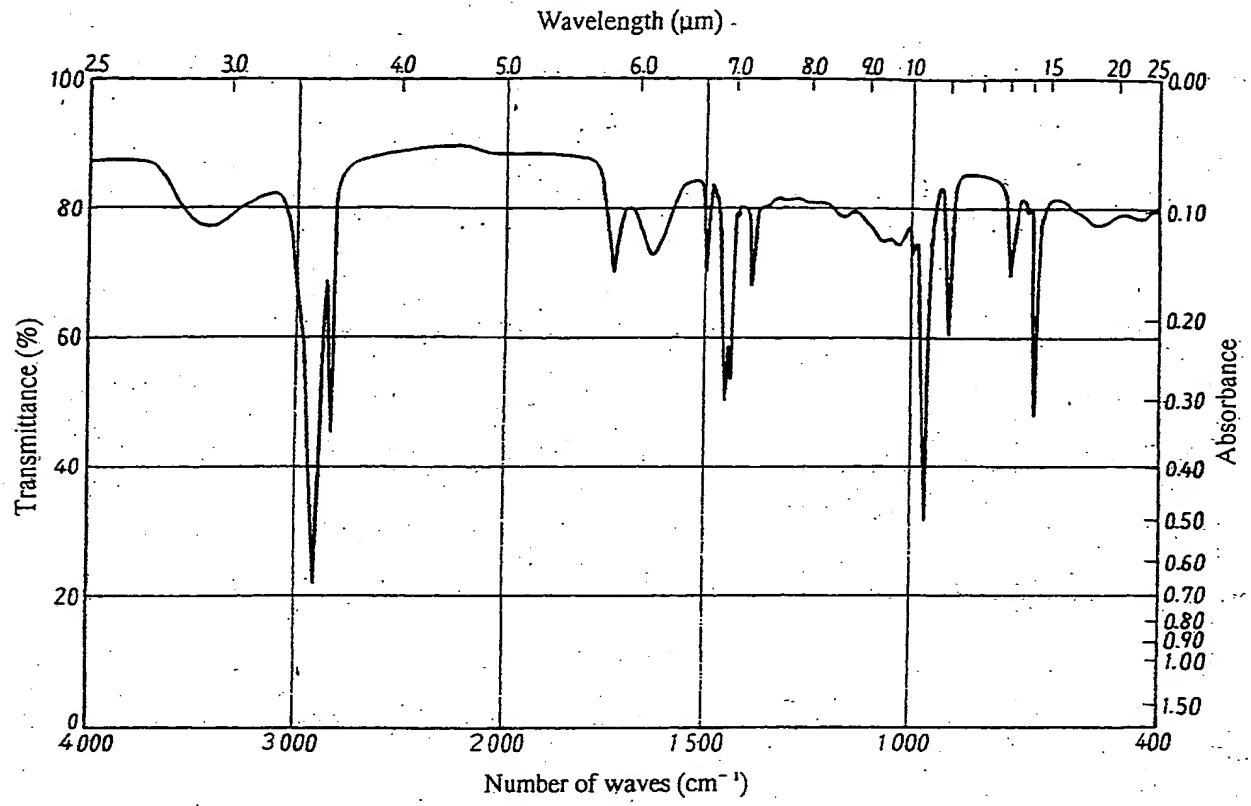
c) Measuring conditions of the infrared absorption spectrum



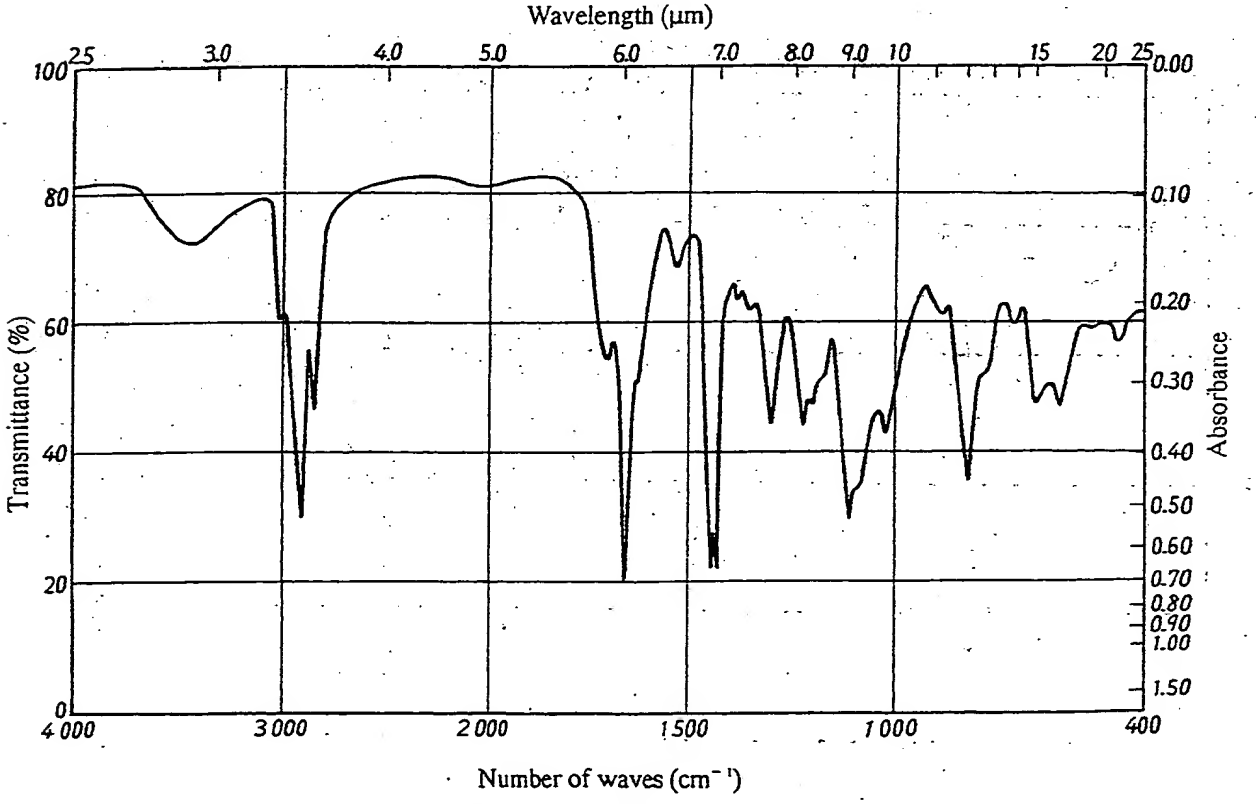
Annex 2 Fig. 1-1 Isoprene rubber



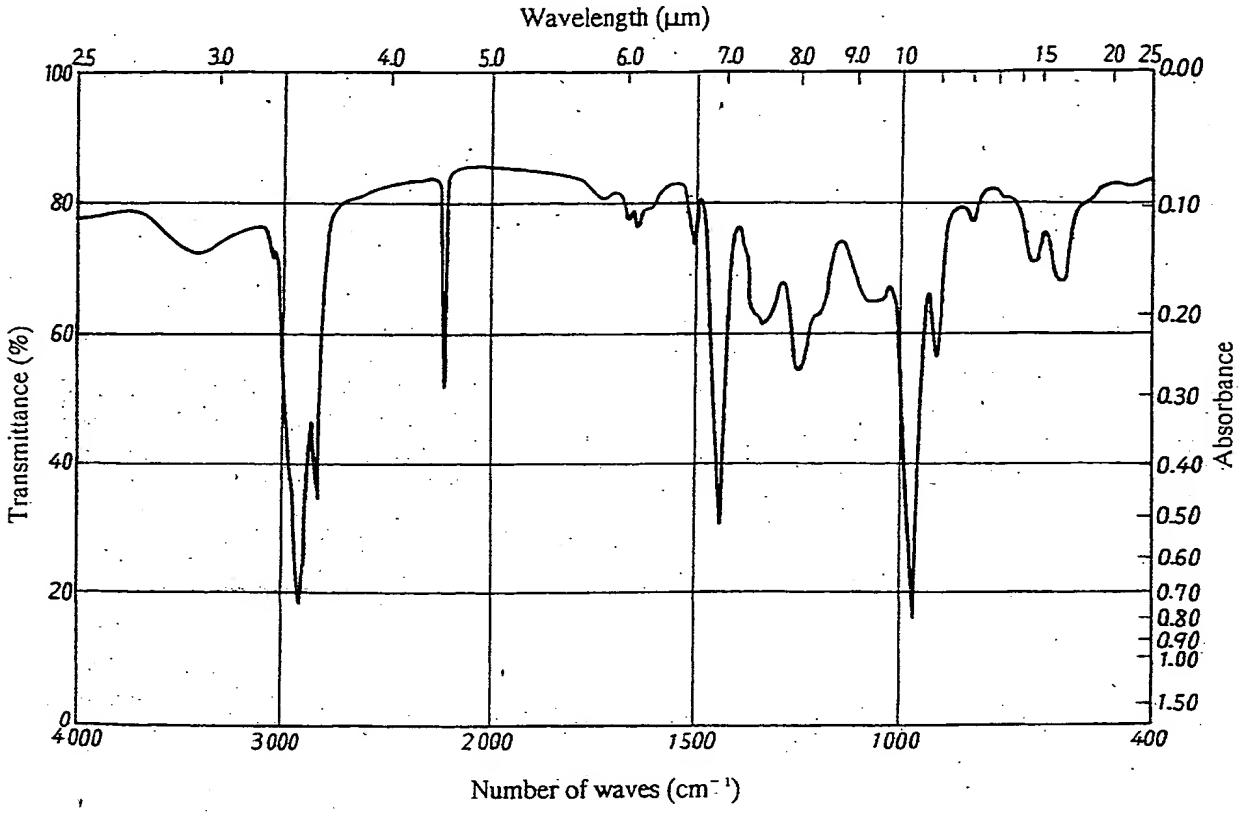
Annex 2 Fig. 1-2 Butadiene rubber



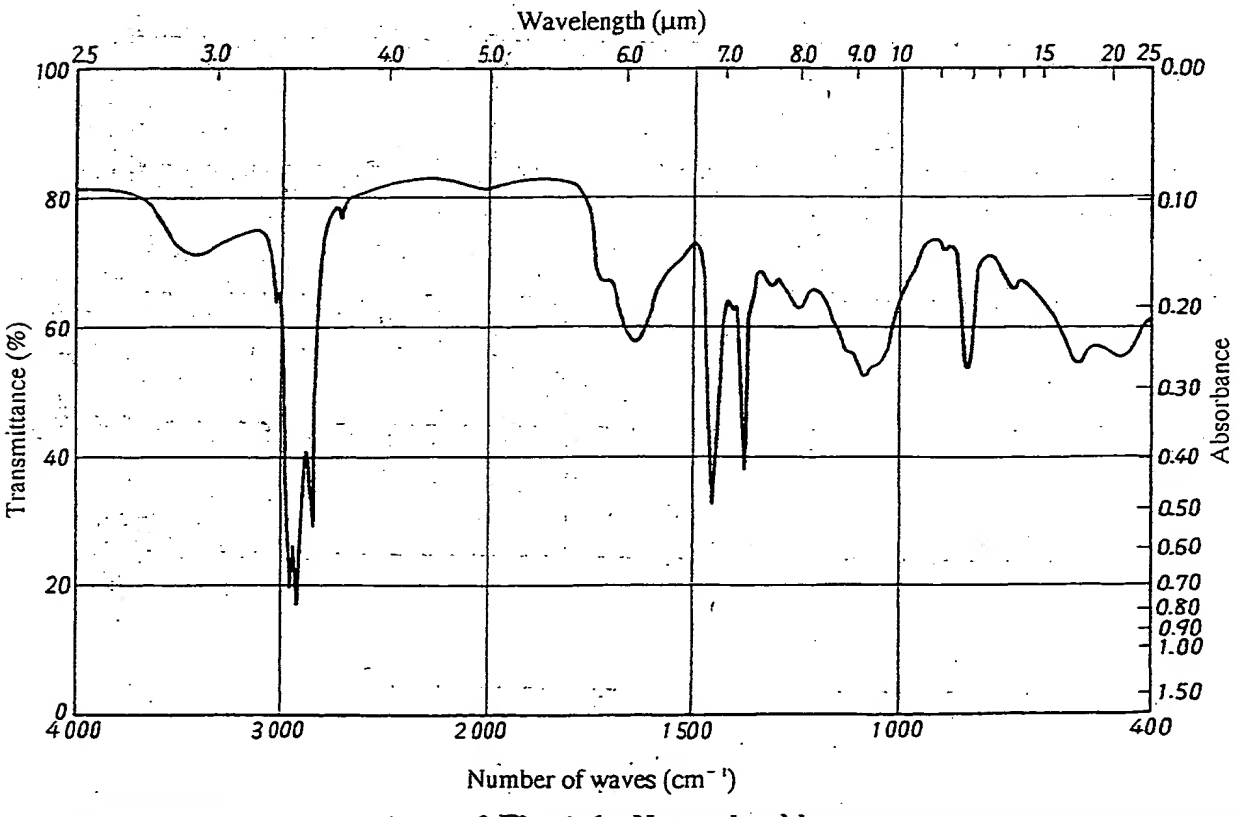
Annex 2 Fig. 1-3 Styrene-butadiene rubber



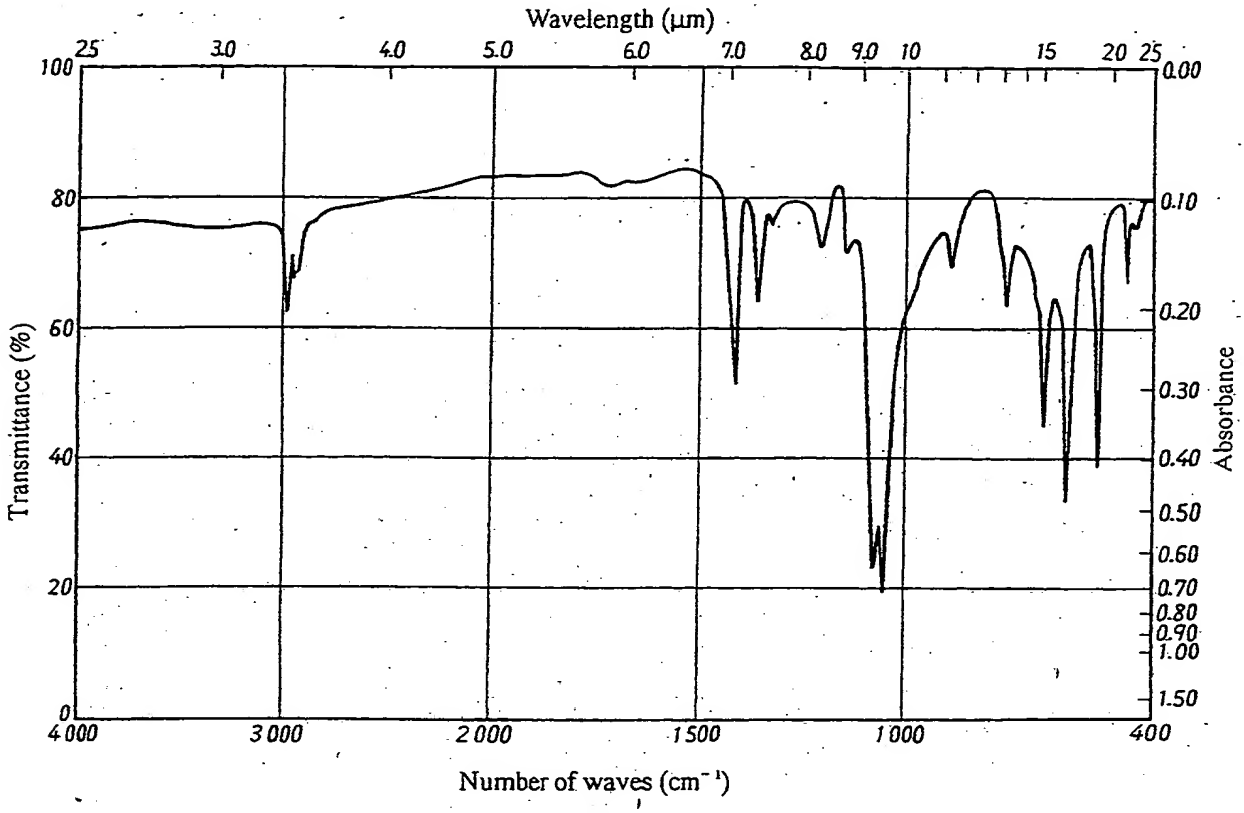
Annex 2 Fig. 1-4 Chloroprene rubber



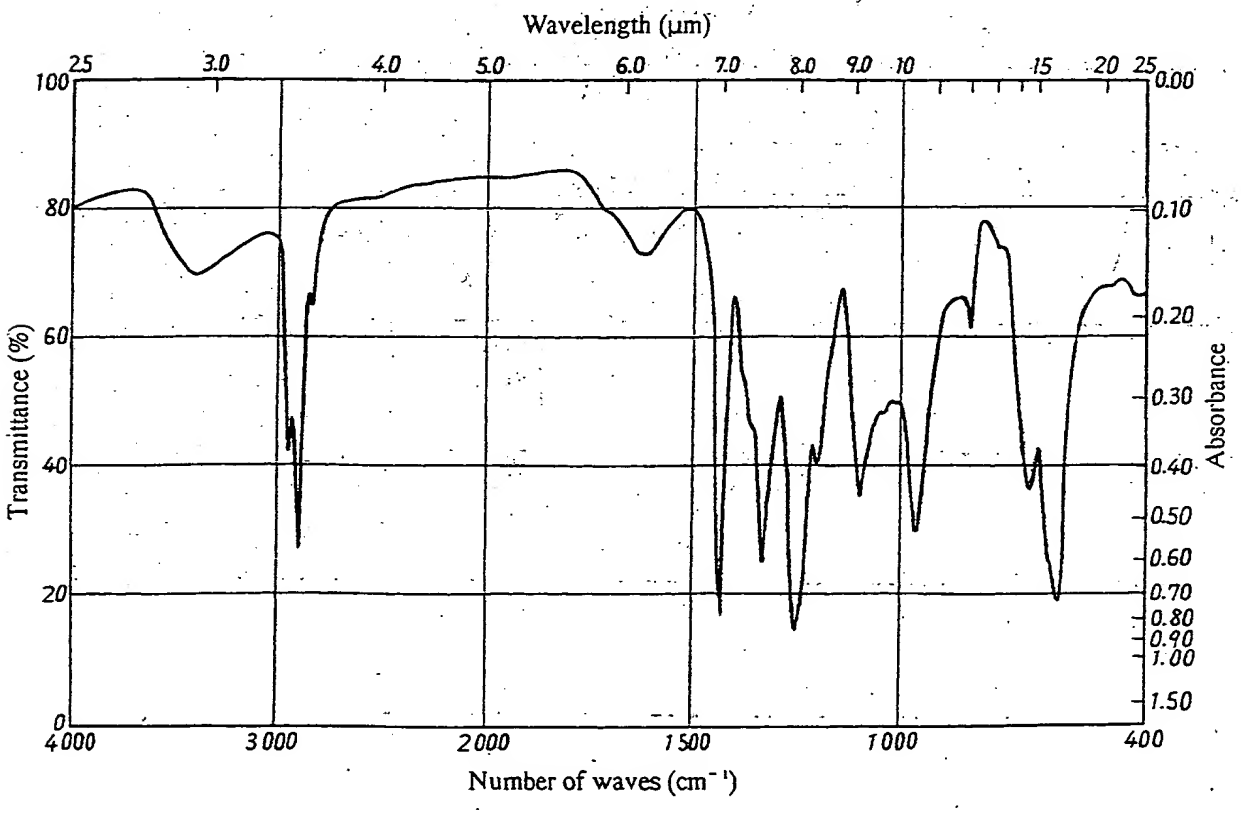
Annex 2 Fig. 1-5 Acrylonitrile-butadiene rubber



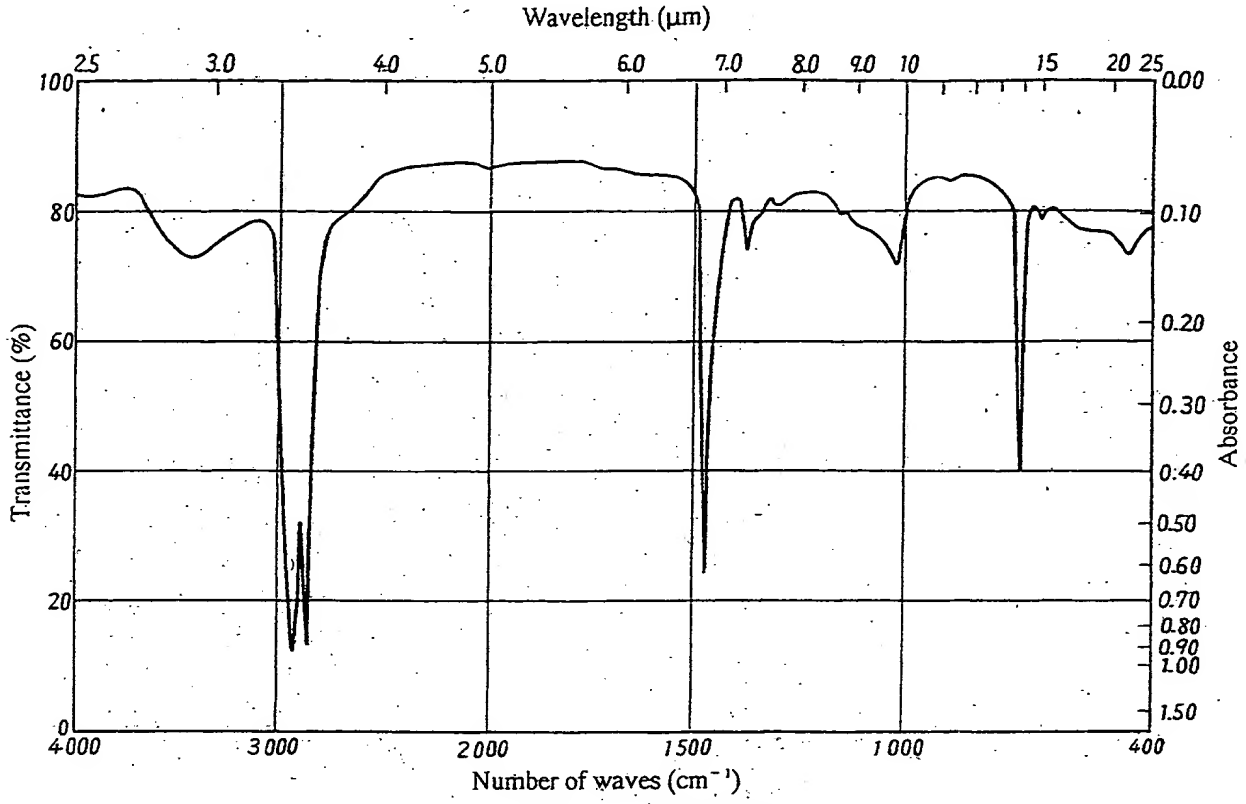
Annex 2 Fig. 1-6 Natural rubber



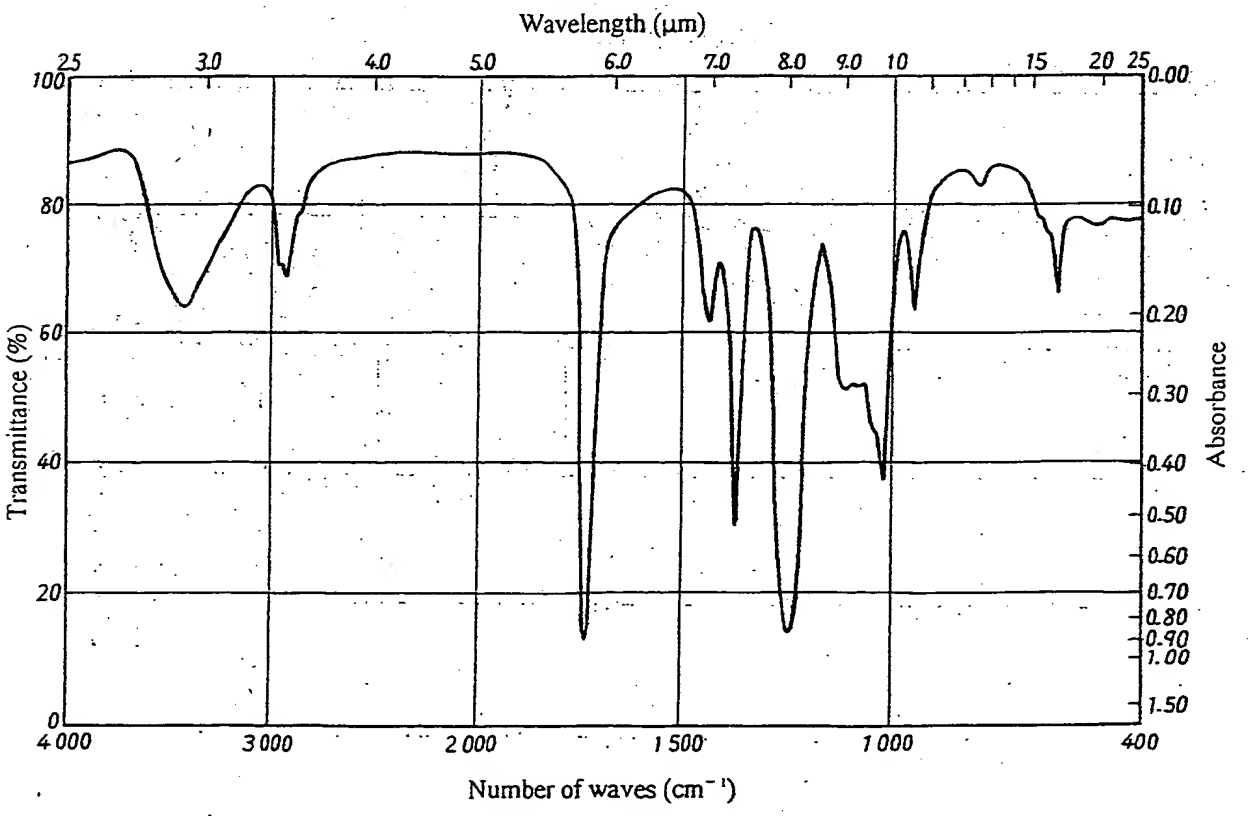
Annex 2 Fig. 2 Polyvinyliden chloride



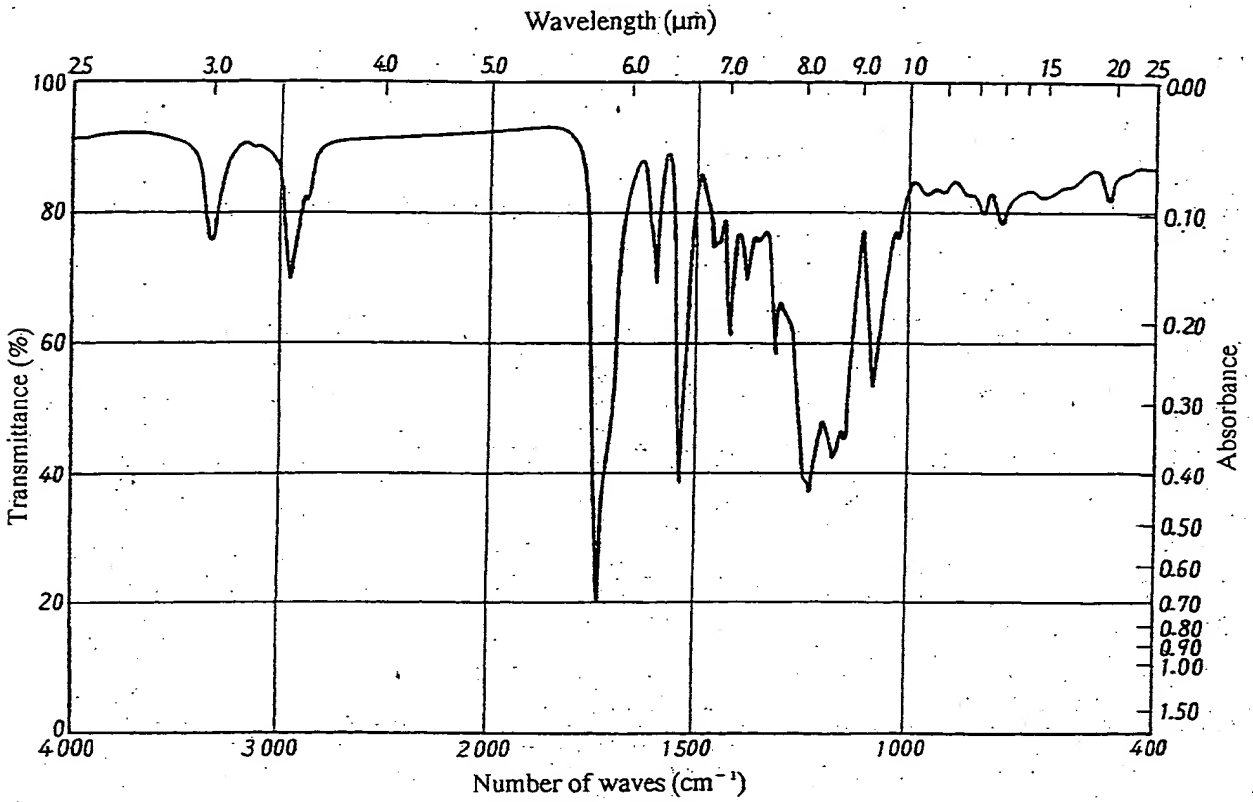
Annex 2 Fig. 3 Polyvinyl chloride



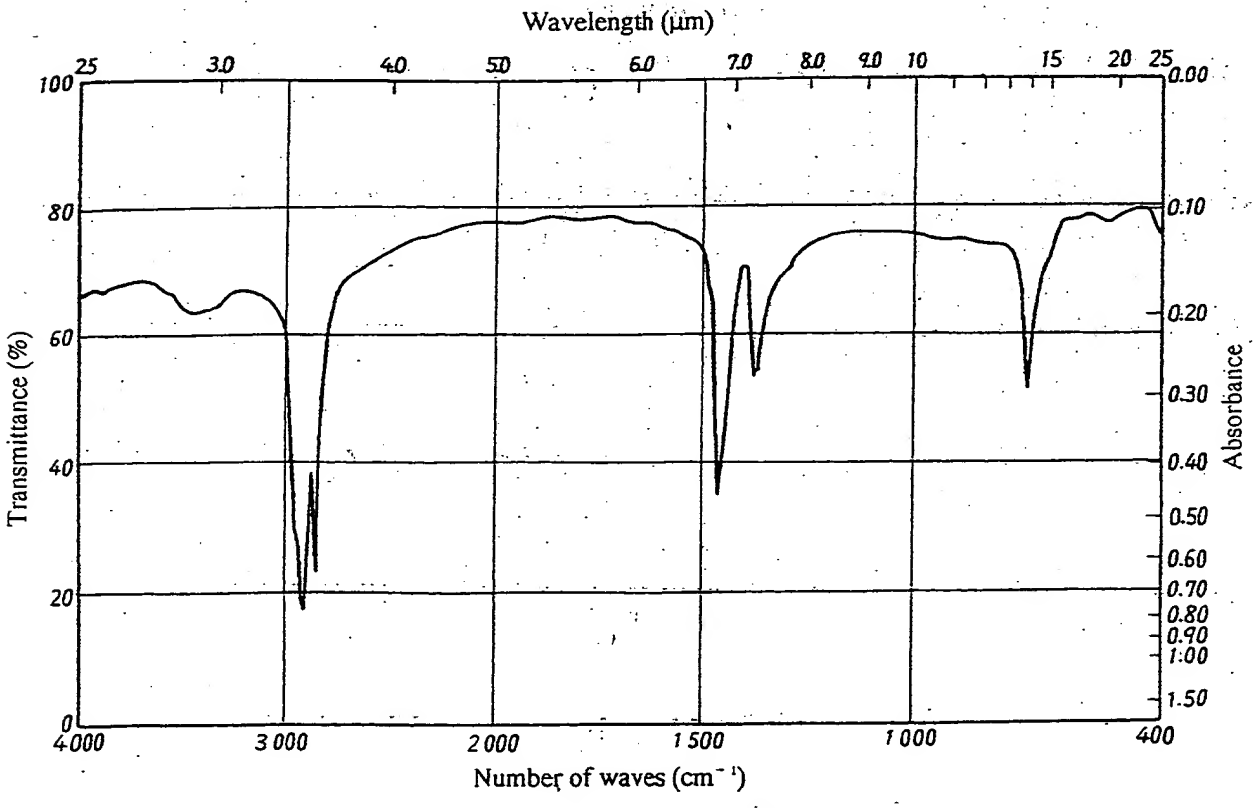
Annex 2 Fig. 4 Polyethylene



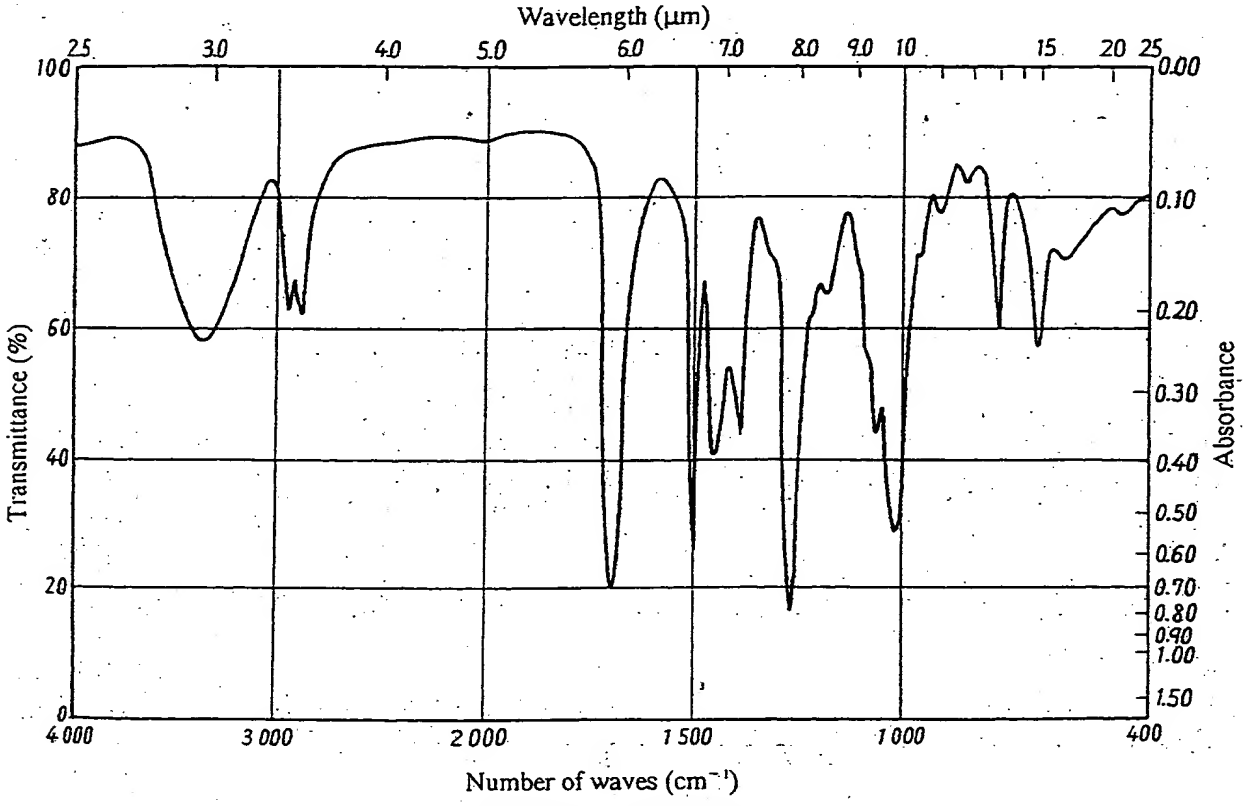
Annex 2 Fig. 5 Polyvinyl acetate



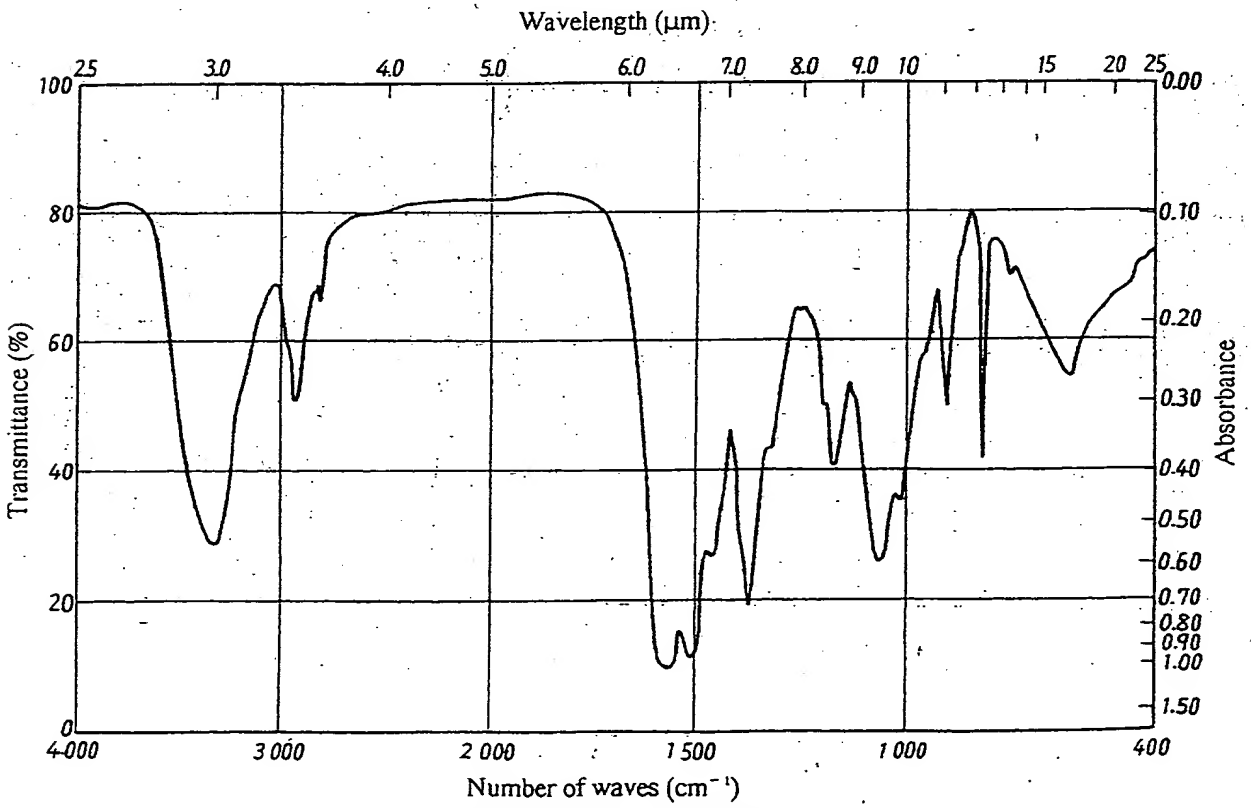
Annex 2 Fig. 6 Polyurethane



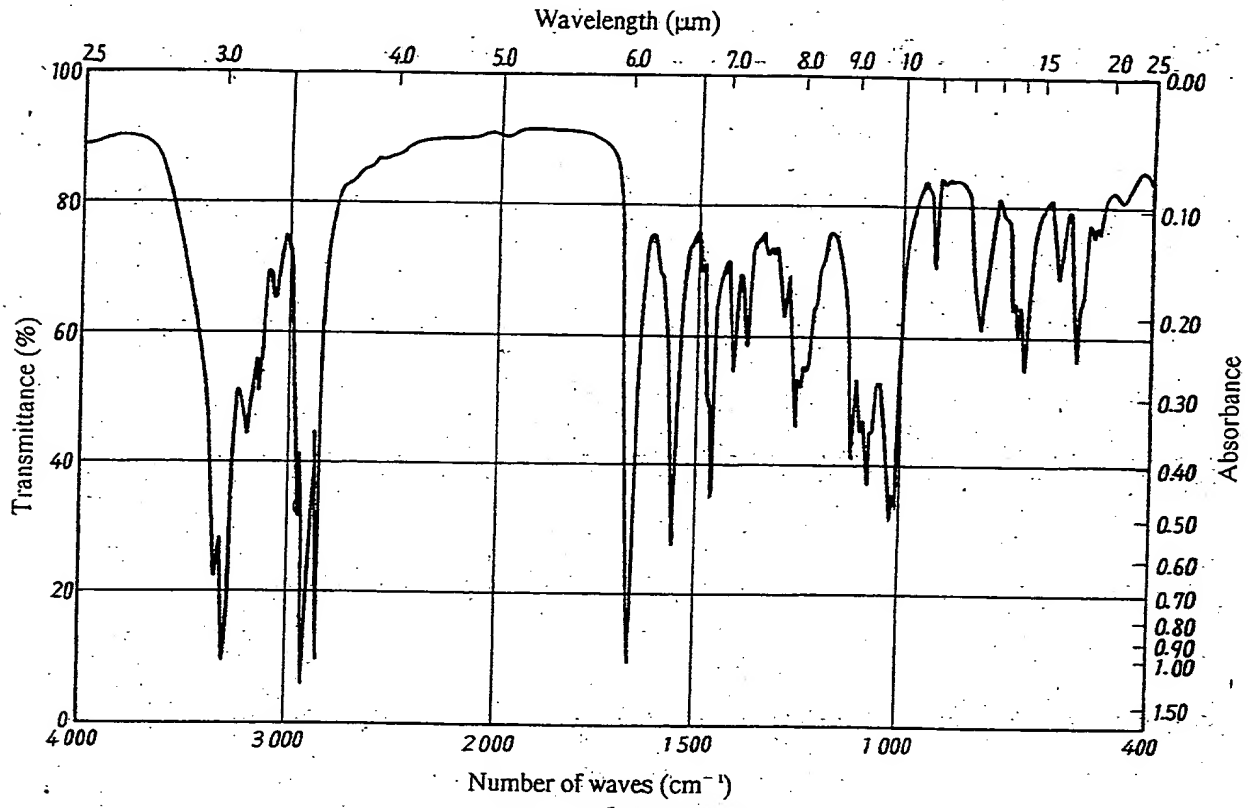
Annex 2 Fig. 7 Paraffin



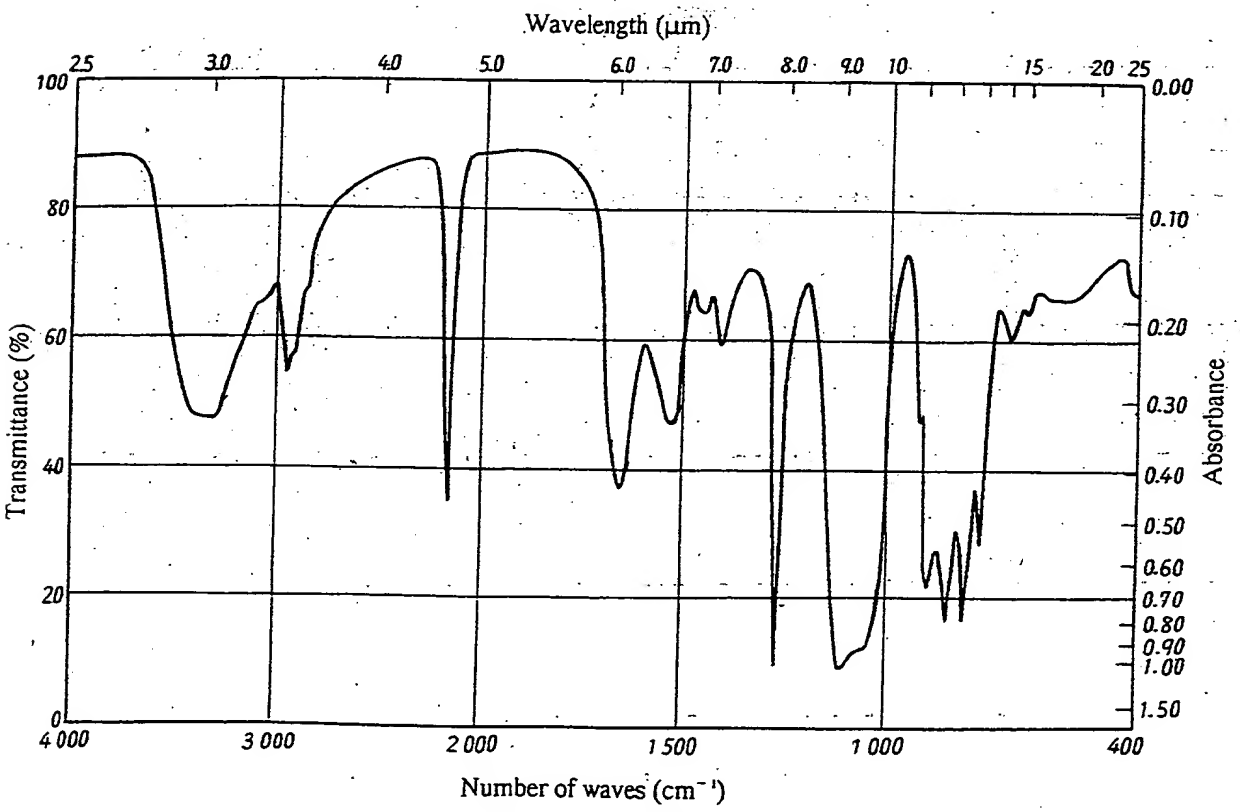
Annex 2 Fig. 8 Ethylene urea



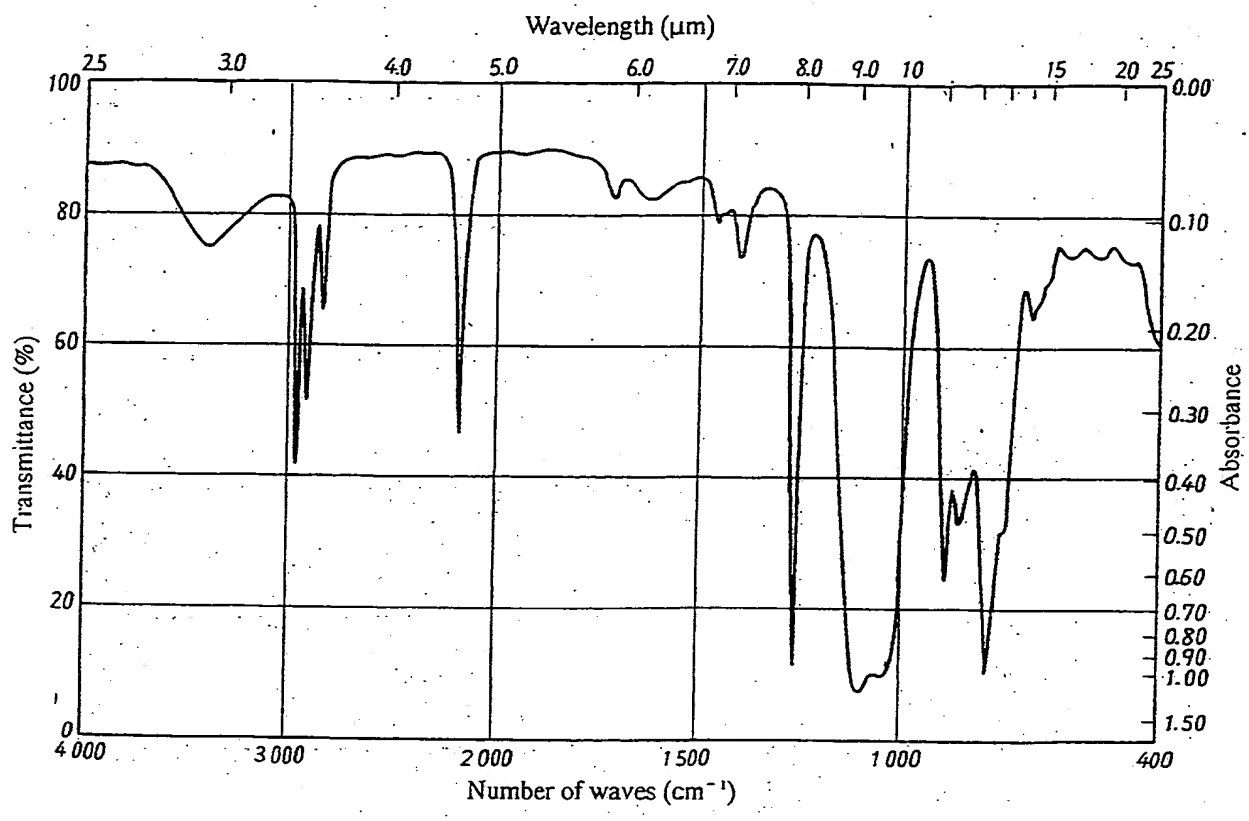
Annex 2 Fig. 9 Melamine



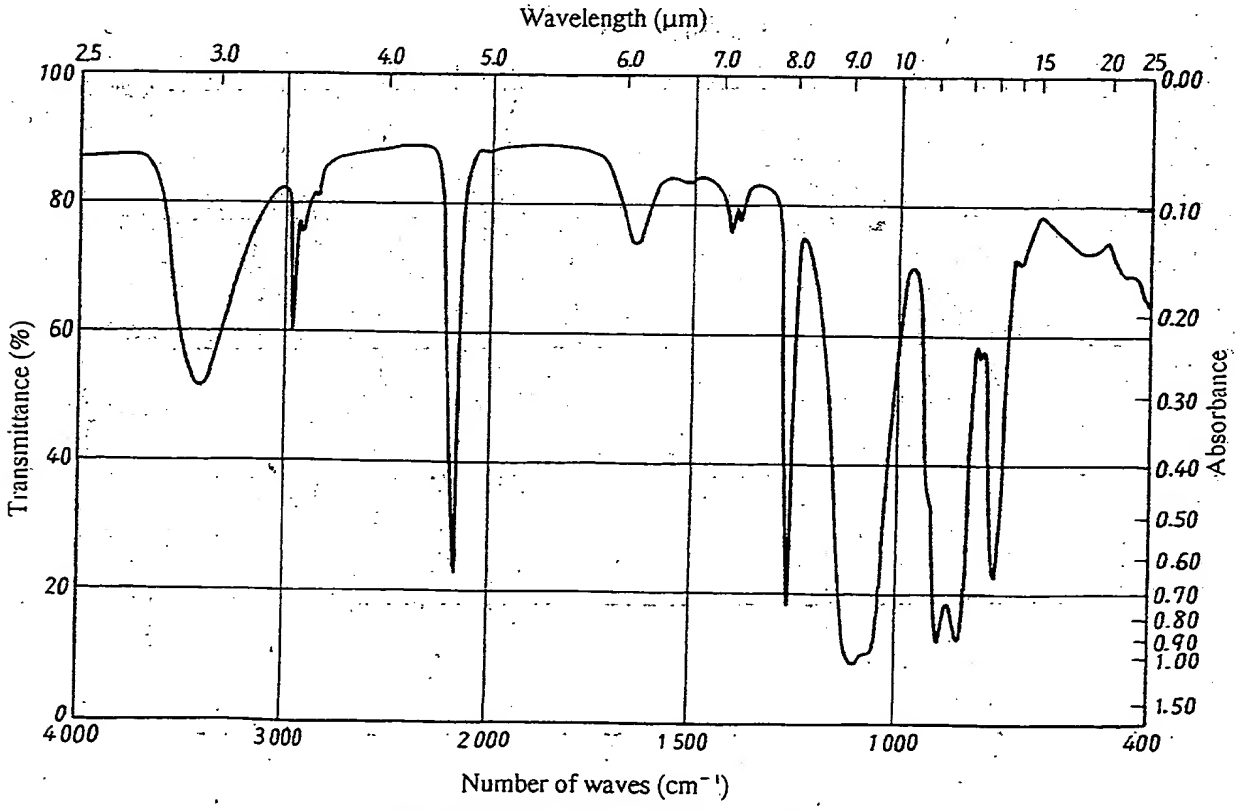
Annex 2 Fig. 10 Methylolamide



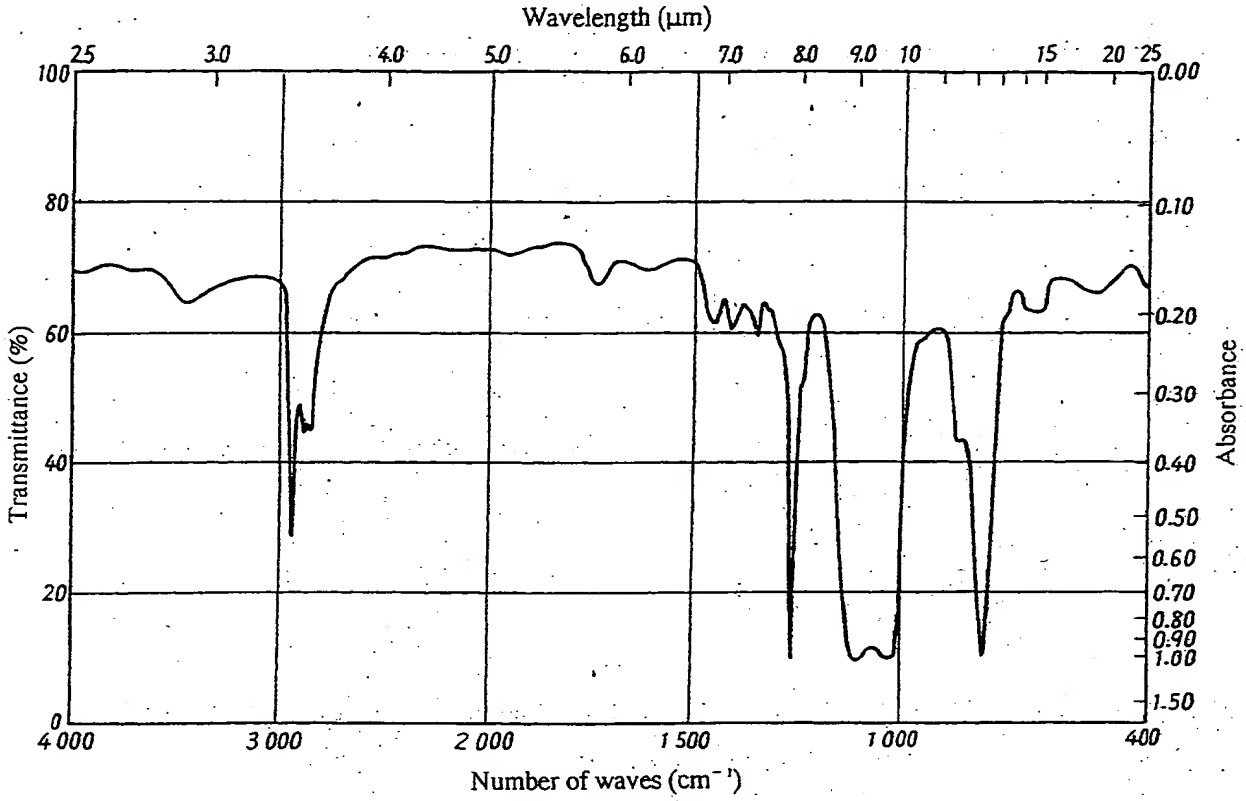
Annex 2 Fig. 11-1 Silicon Part 1



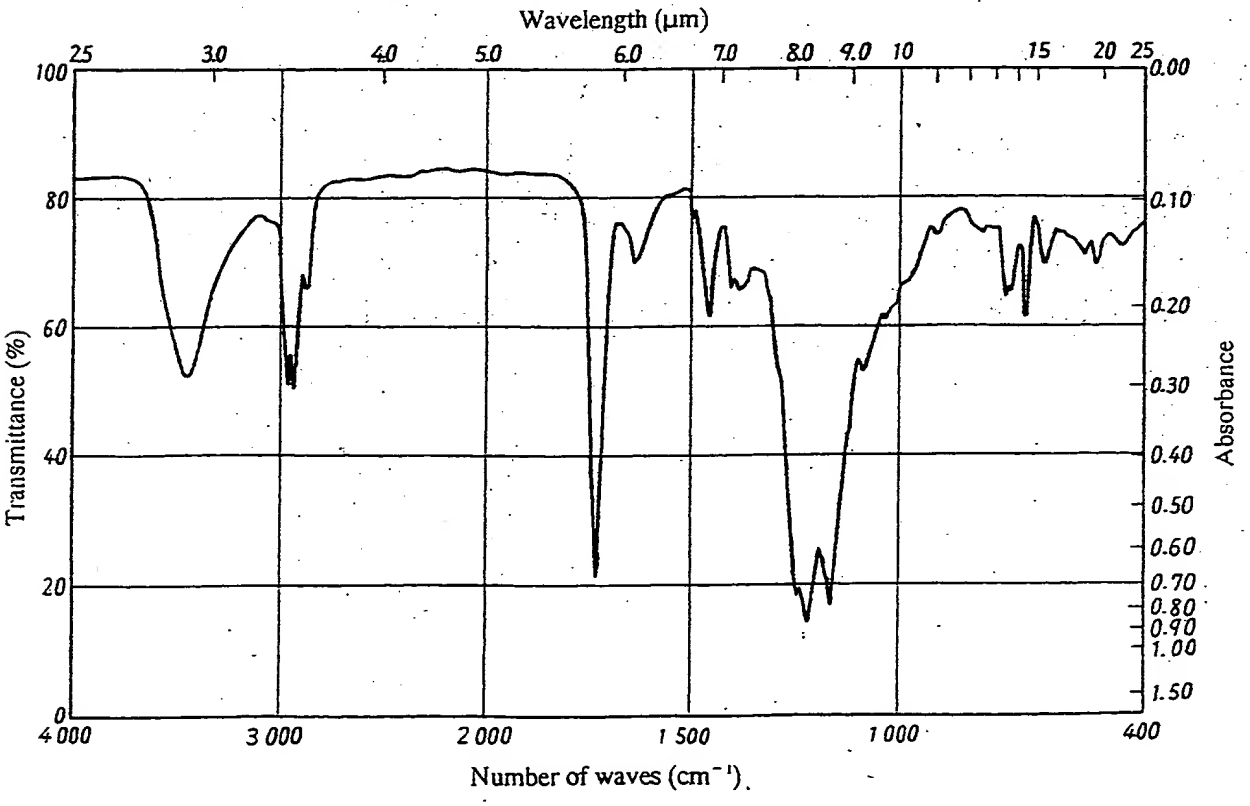
Annex 2 Fig. 11-2 Silicon Part 2



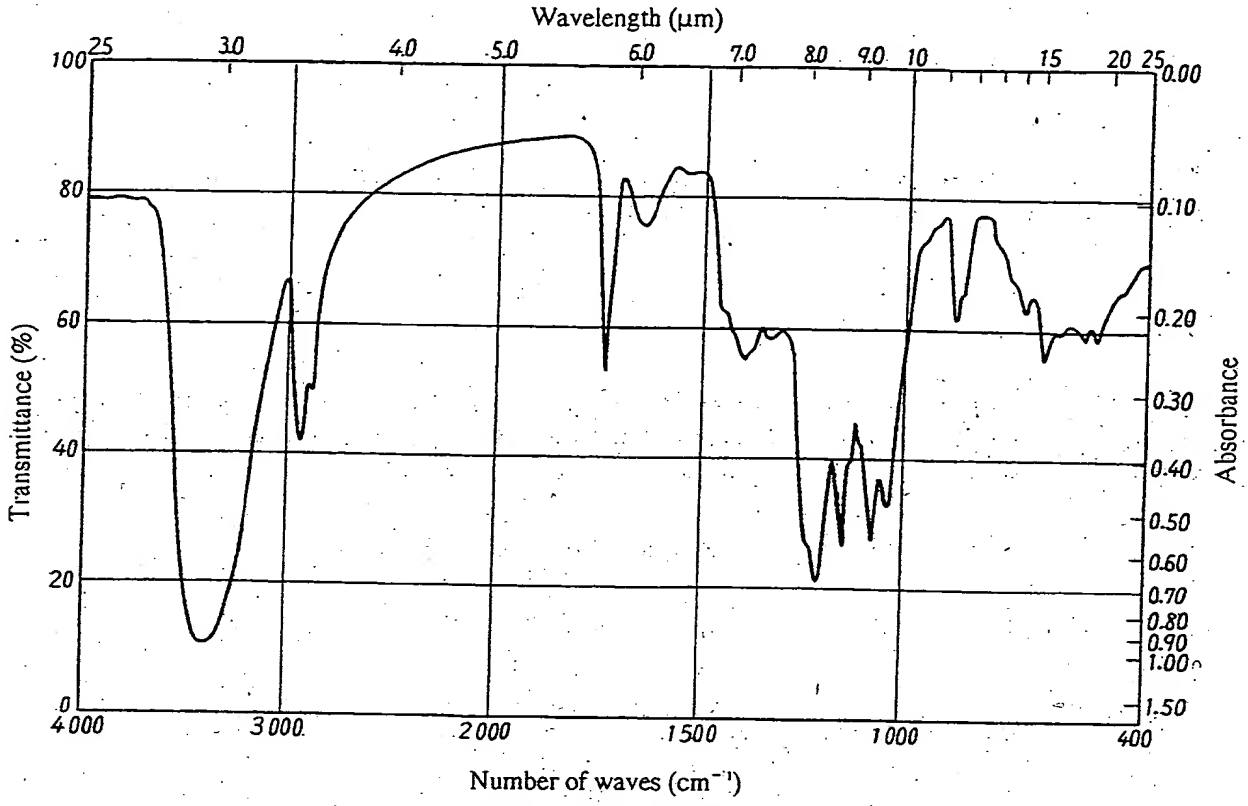
Annex 2 Fig. 11-3 Silicon Part 3



Annex 2 Fig. 11-4 Silicon Part 4



Annex 2 Fig. 12-1 Fluorine Part 1



Annex 2 Fig. 12-2 Fluorine Part 2

Annex 3 (informative) Complement of the body and Annex 1

This Annex 3 is to complement the matters related to the specifications in the body and the Annex 1 thereto and does not form a part of this Standard.

Test methods In addition to the test methods specified in the body, there are the following test methods:

1 Test for resistance to surface wetting (Water drop method) In addition to the test for resistance to surface wetting (Spray test) in **6.2** of the body, there is the following water drop method:

a) **Apparatus and material** The apparatus and material are as follows:

1) **Test piece holder** The test piece holder shall be made of metal and be of 15 cm in diameter.

2) **Burette** A burette capable of dividing to 0.1 ml.

3) **Stopwatch** A stopwatch with a 0.5 s scale.

4) **Water** Use distilled water or ion-exchange water, with the temperature at the time of test, as a rule, (20±2) ℃. If the temperature is other than this, record the temperature.

b) **Procedure** From the specimen specified in 5 of the body, prepare three test pieces of approximately 20 cm × 20 cm, attach to the test piece holder of 15 cm in diameter so that there are no wrinkles, drop 0.1 ml water on each of five places from a height of 2 cm above the flat test piece using a burette, measure the time (s) until the water penetrates into the test piece, and express as the mean value of the three test pieces to one decimal place.

2 Rain test (Shower test) In addition to the rain tests in **6.3** of the body and **3.2** of Annex 1, there are the following Methods A and B. Method A is very similar to **AATCC** Test Method 35 Water Resistance: Rain Test. Method B is very similar to **BS 5066**, Method of test for the resistance of fabrics to an artificial shower.

a) **Method A (AATCC Method)**

1) **Apparatus and material** The apparatus and material are as follows:

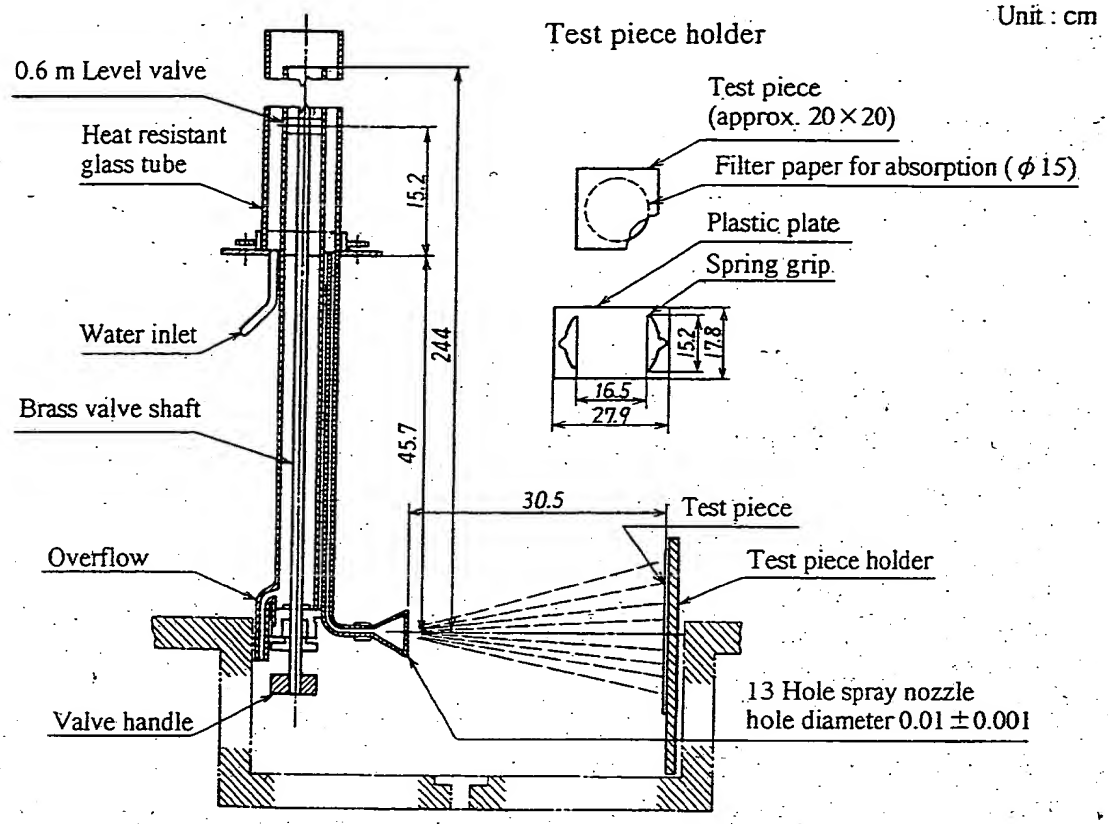
1.1) **Water tester** The water tester is as shown in Annex 3 Fig. 1, and is capable of raising the height of the water column between 0.6 m and 2.4 m, by 0.3 m as a unit.

1.2) **Filter paper for absorption** Use class 2 circular filter paper (15 cm in diameter) as given in **JIS P 3801**.

1.3) **Balance** A balance capable of measuring to the nearest 0.1 g.

1.4) **Water** Use distilled water or ion-exchange water, with the temperature at the time of test, (20±2) ℃. If a different temperature is used, record the temperature.

Unit : cm



Annex 3 Fig. 1 Rain tester

2) **Procedure** From the specimens of 5 of the body, prepare three test pieces of approximately 20 cm × 20 cm (1), press one sheet of 15 cm diameter filter paper for absorption weighed to the nearest 0.1 g tightly to the back of each test piece, fix them to the test piece holder, and attach to the rain tester so that the center of the test piece surface coincides with that of the spray nozzle with 30.5 cm in between. Adjust the height of the water column (2), make the spray nozzle horizontal, supply water from the water inlet, spray from the nozzle for 5 min, immediately weigh by blotting filter paper, calculate the permeation quantity (g) using the following formula, and express the mean value of the three test pieces to one decimal place. Record the height of the water column (cm) at the time of test in the test results.

$$\text{Permeation quantity (g)} = M - M_0$$

where, M_0: mass of the filter paper before the test (g)

M: mass of the filter paper after the test (g)

Notes (1) The test piece may be prepared with a single sheet, double sheets, or material of surface cloth and lining put together as used for raincoats, etc.

(2) Set the height of the water column between 0.6 m and 2.4 m, with a unit of 0.3 m. As required, increase the height of the water column by the unit of 0.3 m from the maximum height where the permeation quantity becomes 0 g until the minimum height where the filter paper is torn or the permeation quantity exceeds 5 g, and determine the permeation quantities at the respective heights of the water column.

b) **Method B (BS Method)** Method B (BS Method) is also called the WIRA method, and is as follows:

1) **Apparatus and material** The apparatus and material are as follows:

1.1) **Shower tester** The shower tester is as shown in Annex 3 Fig. 2. For the shower head, use perforated polytetrafluoroethylene plate as shown in Annex 3 Fig. 3 and for test piece holder, use a ribbed glass receiving plate (81 mm × 135 mm) as shown in Annex 3 Fig. 4

1.2) **Vibrator** The vibrator is such that the test piece holder freely drops 30 cm vertically along the column standing on a heavy stand and strikes a rubber stopper to give an impact to the test piece.

1.3) **Stopwatch** A stopwatch with a 0.5 s scale.

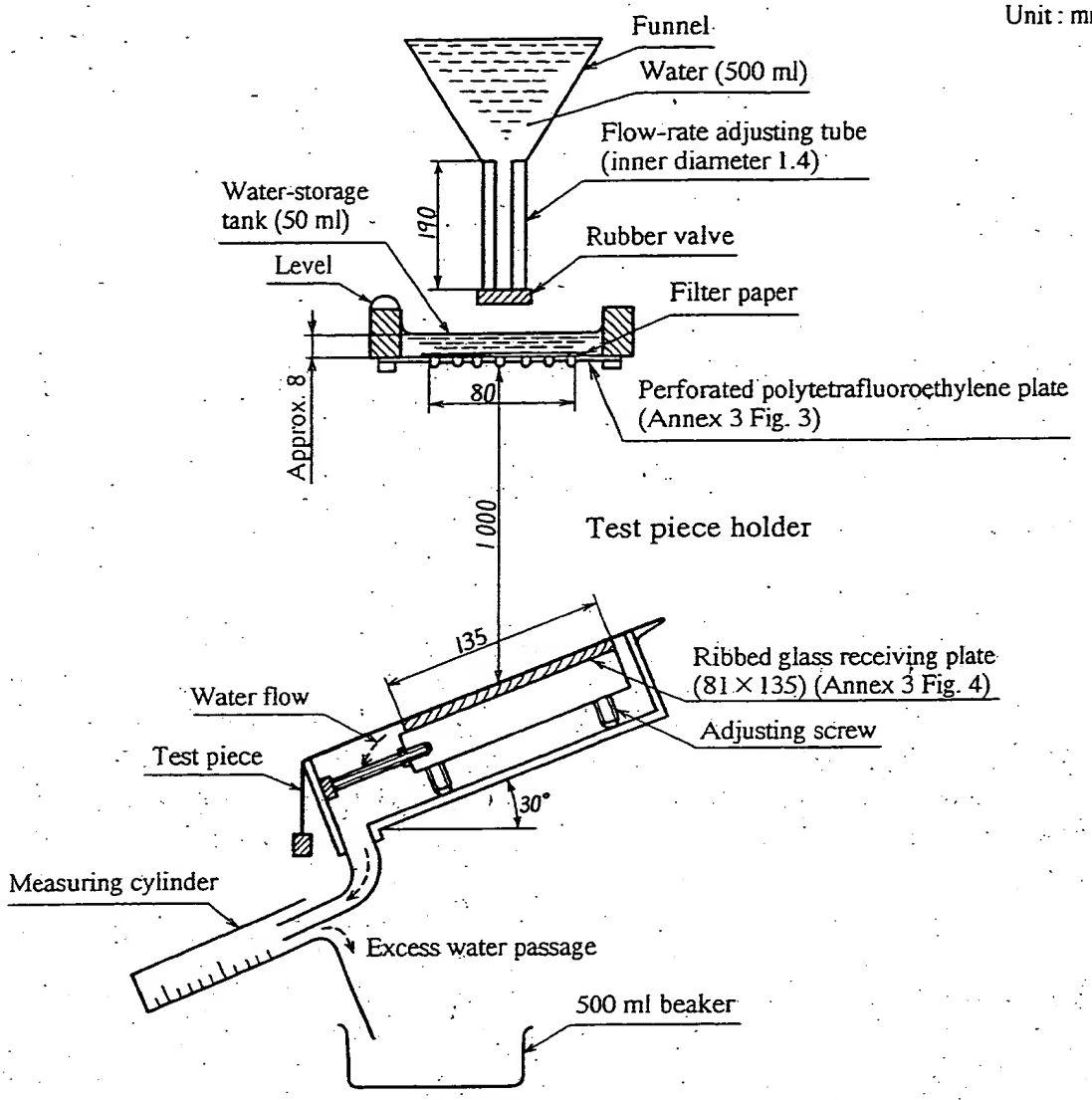
1.4) **Balance** A balance capable of measuring to the nearest 1 mg.

1.5) **Measuring cylinders** Measuring cylinders of 50 ml and 500 ml to pour water into the shower head, and a 10 ml to 500 ml cylinder to measure the quantity of water passing through a test piece.

1.6) **Filter paper** Class 2 filter paper as given in **JIS P 3801**, circular in shape and 90 mm in diameter.

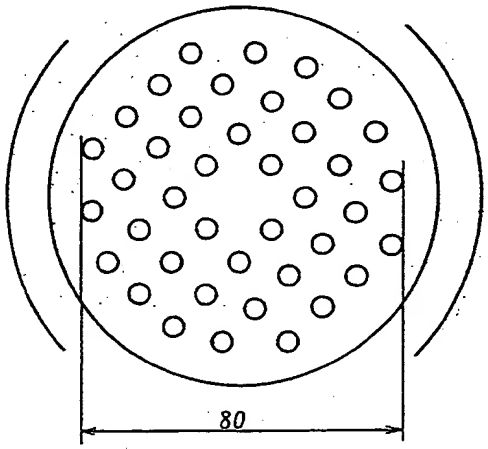
1.7) **Water** Use distilled water or ion-exchange water, with the temperature at the time of test, as a rule, (20±2)℃. If the temperature is other than this, record the temperature.

Unit : mm



Annex 3 Fig. 2 Shower tester

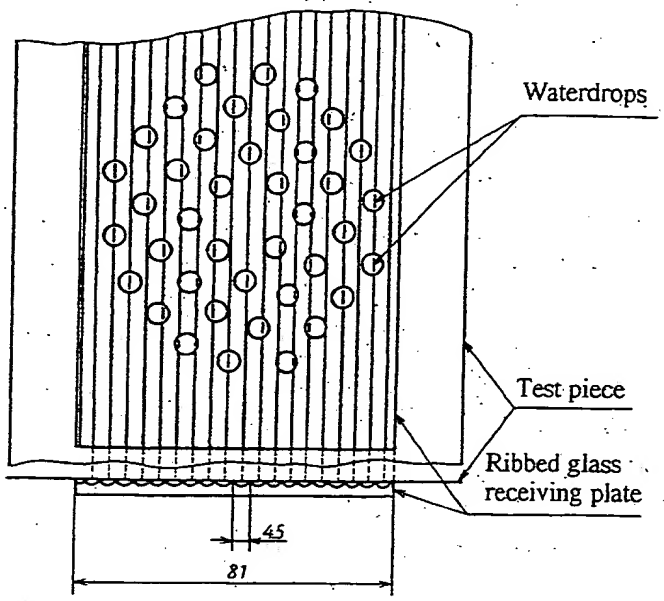
Unit : mm



(Perforated polytetrafluoroethylene plate which has 40 holes of 4 mm in diameter within a circular area of approximately 80 mm in diameter.)

Annex 3 Fig. 3 Shower head

Unit : mm



Annex 3 Fig. 4 Where shower waterdrops fall on the ribbed glass receiving plate

2) **Test preparation** Wash the ribbed glass receiving plate with water ([3]), immerse it in a 2 *l* beaker containing approximately 1.5 *l* of a surface-active agent washing liquid, let stand for 15 min, wash with running water ([3]) for 10 min, further immerse in a 2 *l* beaker containing water at approximately 50 ℃ for 1 min, take it out and dry.

For the shower head part, dry the perforated polytetrafluoroethylene plate using tissue paper, place 90 mm diameter filter paper on top, add 2 ml to 3 ml water to let the plate adhere tightly to the filter paper, further press the filter paper slightly into the holes of the plate, and attach them to the bottom of water storage tank.

Make the water storage tank horizontal using a level, add 50 ml of water, and raise the water level to approximately 8 mm. The water drops pass uniformly from each hole through the filter paper ([4]). Within 2 s to 3 s the water drops stop falling. Confirm that the water level at that time is approximately 5 mm.

From the specimens of **5** of the body, prepare four test pieces of 125 mm × 250 mm. Weigh the mass to the nearest mg, place on the ribbed glass receiving plate, attach to the test piece holder as shown in Annex 3 Fig. 2, fix at the proper place on the tester, and connect the tester to the measuring cylinder and the beaker.

Notes ([3]) The water specified in **1) 1.7)** need not be used.

([4]) If the water drops do not fall uniformly from the holes of the shower head, adjust the position of the filter paper with a glass rod or replace the filter paper.

3) **Procedure** Using the shower tester given in Annex 3 Fig. 2, pour 500 ml of water into the glass funnel, open the valve under the flow-rate adjusting tube, and spray over the test piece for approximately 7.5 min ([5]). 8.5 min $^{+20}_{0}$ s later, detach the test piece, use the vibrator to remove the excess water-drops, and immediately weigh the mass to the nearest 1 mg ([6]). Calculate the water absorption (%) of the test piece using the

following formula, and measure the volume of water received by the measuring cylinder after passing through the test piece, as shown in Annex 3 Fig. 2, which is taken as the water leakage (ml) ([7]), and express the water absorption and water leakage as the mean value of the four test pieces ([8]).

$$\text{Water absorption } (\%) = \frac{M - M_0}{M_0}$$

where, M_0: mass of the test piece before the test (mg)

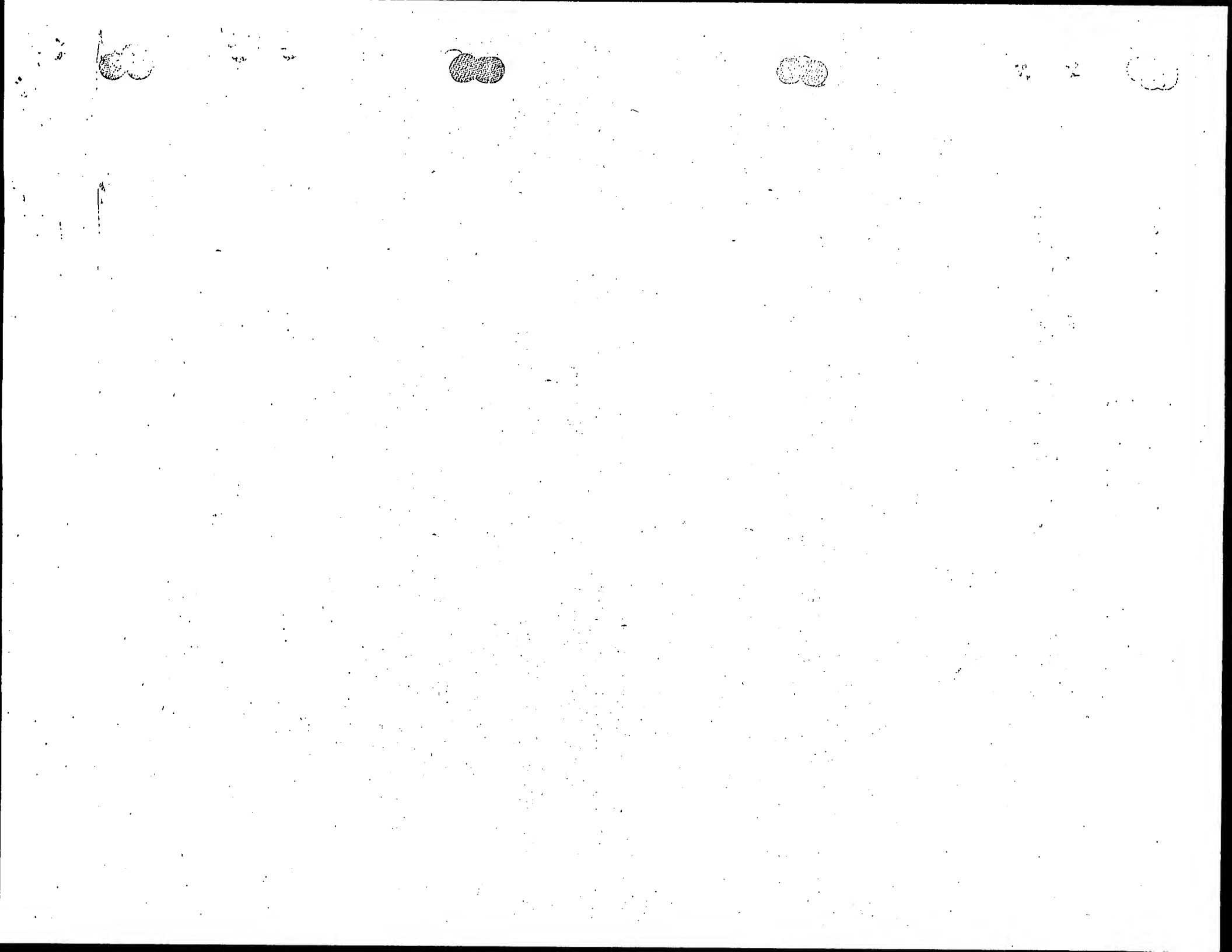
M: mass of the test piece after the test (mg)

Notes ([5]) Adjust the flow-rate adjusting tube so that 500 ml water drops in 7.5 min $\pm$ 10 s. Open the valve so that the water in the funnel maintains the water level in the water storage tank at approximately 7 mm, giving a stable shower flow (at this time, the waterdorps are approximately 65 mg).

([6]) In order to prevent the loss of water from the test piece with water absorbed, weight the test piece in a closed container.

([7]) If necessary, measure the time until the amount of water leakage reaches 10 ml.

([8]) Measure to the nearest 0.5 % if the water absorption is 10 % or less, and to the nearest 1 % if it exceeds 10 %. Measure to the nearest 0.5 ml if the amount of water leakage is 10 ml or less, and to the nearest 1 ml if it exceeds 10 ml.



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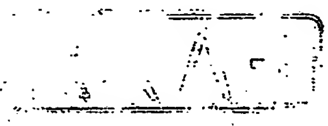


Exhibit B

繊維製品の防水性試験方法　L 1092-1986

Testing Methods for Water Resistance of Clothes

1. 適用範囲　この規格は，繊維製品の防水性の試験方法について規定する。

備　考　1. 防水性とは，耐水性，はっ水性，撥水性などの総称である。

2. 防水加工剤の部屋判定方法を附属書に規定する。

3. この規格の中で（　）を付けて示してある数値及び単位は，従来単位によるものであって規格値である。

2. 用語の意味　この規格で用いる主な用語の意味は，次のとおりとする。

（1） 試験室の標準状態　試験室の温度，湿度及びそれらの許容差が JIS Z 8703（試験場所の標準状態）に規定の 20±2℃，65±2％ RH の状態。

備　考　JIS Z 8806（湿度測定方法）の気象庁形又はアスマン通風乾湿球温度計を用いて温度を求め，次にスプルングの式による湿度表によって相対湿度を求める。

（2） 試料の標準状態　試料を標準状態の試験室に放置し，恒量となった状態。

（3） 恒　量　試料の質量を1時間以上の間隔で量り，その前後の質量差が後の質量の 0.1％ 以内になったときの試料の質量。

3. 試料の採取及び調製

3.1 試料の採取及び準備　試料は原則として，試料が織物又は編物の場合は，両耳端から$\frac{1}{10}$ずつ，端末から1m以上離れた部分から，試料が製品の場合には表生地から無作為に採取し，標準状態とする。

備　考　試験室を標準状態に保てない場合は，試料を 20±2℃ に保った密閉容器（36％ 硫酸在中）の中に入れ恒量にする。

3.2 試料の前処理　3.1 の試料について，必要がある場合は，次の各処理を単独又は組み合わせて行ってから5.の試験をする。

備　考　前処理を行った試料の防水性保持率は，処理前と処理後の試料を 5. の試験方法によって試験し，次の式によって算出する（小数点以下1けたまで）。

$$防水性保持率(\%)=\frac{A}{A_0}\times 100$$

ここに，A_0：前処理を行っていない試料の試験値

A：前処理を行った試料の試験値

（1） 洗濯処理　この処理は，次のいずれかの方法による。

（a） A法（かくはん形洗濯機を用いる方法）　JIS L 1096（一般織物試験方法）の 6.23.1 の A法に規定する方法とし，乾燥方法はドリップ乾燥とする。

（b） B法（シリンダ形洗濯機を用いる方法）　JIS L 1096 の 6.23.2 の B法に規定する方法。

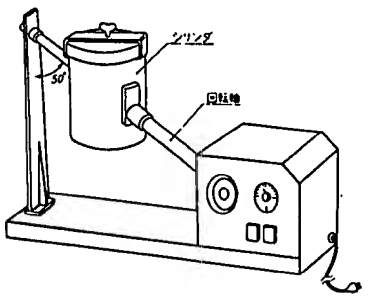
（c） C法（家庭用電気洗濯機を用いる方法）　JIS L 0217（繊維製品の取扱いに関する表示記号及びその表示方法）の別表 記号別の試験方法（1）洗い方（水洗い）番号 103 に規定する方法。

（2） ドライクリーニング処理　図1のウオッシュシリンダ形洗濯装置のシリンダに約30℃のパークロロエチレン(1)を約 3.78 l を入れ，その中へ約 50×50cm の試料と負荷布(2)を合わせて約 0.45kg となるように調整したものを投入し，10分間運転する。

脱水は原則として遠心脱水機で大体水が流出しなくなるまで行うが，それができないときは，軽く押さえて水を切り，ろ紙又は布の間に挟み，押さえて脱水する。マングルで絞ってはならない。

乾燥は次の4種類のうちから，いずれか一つを選んで行う。

図 1　ウオッシュシリンダ形洗濯装置



シリンダ容積	11.34 l
回転軸角度	50°
回転速度	毎分 約45回転

注（1） JIS K 1521［パークロロエチレン(テトラクロルエチレン)］に規定のもの。

（2） JIS L 0803（染色堅ろう度試験用添付白布）の綿布（添付白布3号）を用い，周辺を縫取りしたもので，原則として試験片と同じ大きさとする。

（a） スクリーン乾燥　脱水後，取り出した試料をねじったり伸ばしたりすることなく不自然なしわを除いて，水平なスクリーンメッシュ又は類似の穴のあいた面上に載せて広げて乾燥させる。乾燥は自然乾燥を原則とするが，試験の能率を向上させるために 70℃ 以下の乾燥機で乾燥してもよい。

（b） ライン乾燥　脱水後，たて糸方向又はウェール方向が鉛直になるように，二隅をつかみ，室温で，風通しのない所でつるして乾燥する。

備　考　ライン乾燥は，ウェール方向に伸びやすい編地には用いない方がよい。

（c） ドリップ乾燥　試料を脱水することなく，たて糸方向又はウェール方向が鉛直になるように，二隅をつかみ，室温で風通しのない所につるして乾燥する。

備　考　ドリップ乾燥は，ウオッシュ・アンド・ウエア性の生地に用いる。

（d） タンブル乾燥　脱水後，タンブル乾燥機に入れて 50～70℃ の温度で 30 分間又は乾燥するときまで運転する。

（3） 耐候処理　JIS K 2246（さび止め油）の 4.34 加速風化 に規定する方法とし，1回の処理時間は 20 時間とする。

4. 試験の種類　試験の種類は，次のとおりとする。

（1） 耐水度試験　この試験は，原則として通気性のない繊維製品に適用する。

（1.1） A法（低水圧法）

（a） 静水圧法　　（b） 一定水圧法　　（c） 漏 水 法

（1.2） B法（高水圧法）

（a） 静水圧法　　（b） 一定水圧法　　（c） 漏 水 法

参　考　B法（高水圧法）は，通常，10kPa 以上の水圧を加えて試験することが適当な試料に適用する。

（2） はっ水度試験（スプレー試験）　この試験は，原則として通気性のある繊維製品に適用する。

（3） 雨試験（シャワー試験）

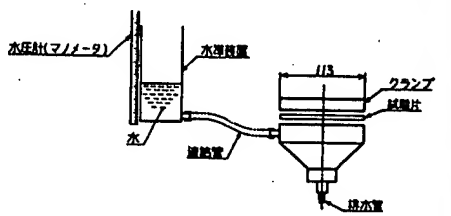
5. 試験方法

5.1 耐水度試験　この試験には，A法（低水圧法）とB法（高水圧法）があり，両方法とも 静水圧法，一定水圧法又は漏水法によって試験を行う。

5.1.1 A法（低水圧法）　A法（低水圧法）は，次による。

図 2　耐水度試験装置（低水圧用）

単位 mm



（1） 装置及び材料　装置及び材料は，次のものを用いる。

（a） 耐水度試験装置（低水圧用）　図2 に示す装置で，水準装置は 60±3 cm/min 及び 10±0.5cm/min の速さで上昇できるもの。

また，クランプは試験片の水に当たる部分が 100 cm² の大きさのもの。

（b） 水圧計（マノメータ）　0.5cm 目盛で，水準装置を上昇させたときの最高水位が約1～2mのもの。

（c） ストップウオッチ　0.5秒目盛のもの。

（d） メスシリンダー　ml 目盛のもの。

（e） 水　蒸留水又はイオン交換水を用い，試験時の温度は原則として 20±2℃ とするが，他の場合はそのときの温度を付記する。

（2） 操　作　3. の試料から，約 15×15cm の試験片を次の各試験につきそれぞれ4枚ずつ採取し，図2の耐水度試験装置に試験片の表側(1)が水に当たるように取り付け，水を入れた水準装置を 60±3 cm/min 又は 10±0.5cm/min の速さで上昇させて，次の各方法で耐水度を求め，4回の平均値で表す(小数点以下1けたまで)。この場合，用いた方法を付記する。

注（1） 表側とは，防水面又は使用時に水が当たる側をいう。

（a） 静水圧法　水位を上昇させて，試験片の裏側に3か所から水が出たときの水位（0.5cm まで）を測る。

ただし，水位を上昇させても3か所から水が出ない場合は，1か所又は2か所から水が出たときまでの水位を測り，その旨を付記する。

なお，水滴が現れてから大きくならない非常に小さい水滴は，計算に入れない。

（b） 一定水圧法　水位を一定水位に上昇させて放置したとき，試験片の裏側に3か所から水が出たときまでの時間（0.5秒まで）を計る。試験結果には，一定水位を付記する。ただし，3か所から水が出ない場合は，1か所又は2か所から水が出たときまでの時間を計るか，高い水位に変更して行い，その旨を付記する。

なお，水滴が現れてから大きくならない非常に小さい水滴は，計算に入れない。

（c） 漏 水 法　水位を一定水位に上昇させた後，一定時間後に試験片を透過した水をメスシリンダーに入れてその体積（ml）を量り，単位面積（cm^2）当たりで表す。試験結果には，一定水位及び一定時間を付記する。

参 考　A法は，ISO 811 (Textile fabrics—Determination of resistance to water penetration by hydrostatic pressure test) と同様な試験方法であるが，同ISO規格は，静水圧法だけを規定している。

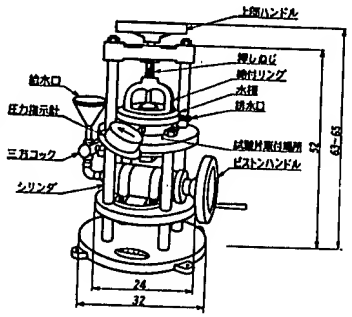
5.1.2 B法（高水圧法）　B法（高水圧法）は，次による。

（1） 装置及び材料　装置及び材料は，次のものを用いる。

（a） 耐水度試験装置（高水圧用）　図3に示すもので，1分間に100 kPa {1 kgf/cm^2} の割合で水圧を加えることができるもの。

図 3　耐水度試験装置（高水圧用）

単位 cm



（b） ストップウオッチ　0.5秒目盛のもの

（c） メスシリンダー　ml目盛のもの

（d） 水　蒸留水又はイオン交換水を用い，試験時の温度は原則として20±2℃とするが，他の場合はそのときの温度を付記する。

（2） 操　作　3.の試料から，約15×15cmの試験片を次の各試験につきそれぞれ4枚ずつ採取し，図3の耐水度試験装置に試験片の表側（*）が水に当たるように取り付け，シリンダに水を入れ，ピストンハンドルを回して1分間に100 kPa {1 kgf/cm^2} の割合で水圧を加え，次の各方法によって耐水度を求め，4回の平均値で表す（小数点以下1けたまで）。この場合，用いた方法を付記する。

（a） 静水圧法　水圧を加えて，試験片の裏側に3か所から水が出たときの水圧（kPa {kgf/cm^2}）を測る（圧力指示計の目盛の$\frac{1}{2}$まで）。ただし，水圧を上げても3か所から水が出ない場合は，1か所又は2か所から水が出たときの水圧を測り，その旨を付記する。

なお，水滴が現れてから大きくならない非常に小さい水滴は，計算に入れない。

（b） 一定水圧法　一定水圧を加えて放置したとき，試験片の裏側に3か所から水が出るときまでの時間（0.5秒まで）を計る。試験結果には，一定水圧（kPa {kgf/cm^2}）を付記する。ただし，3か所から水が出ない場合は，1か所又は2か所から水が出たときまでの時間を計るか，高い水圧に変更して行い，その旨を付記する。

なお，水滴が現れてから大きくならない非常に小さい水滴は，計算に入れない。

（c） 漏 水 法　一定水圧を加えた後，一定時間後に試験片を透過した水をメスシリンダーに集めて，その体積（ml）を量り，単位面積（cm^2）当たりで表す（小数点以下1けたまで）。試験結果には，一定水圧（kPa {kgf/cm^2}）及び一定時間を付記する。

5.2 はっ水度試験（スプレー試験）　はっ水度試験は，次による。

（1） 装置及び材料　装置及び材料は，次のものを用いる。

（a） はっ水度試験装置　図4に示すもので，ガラス漏斗は250ml以上の容量，スプレーノズルは250mlの水を25～30秒で散布できること。

（b） 試験片保持枠　直径150mmの金属製のもの。

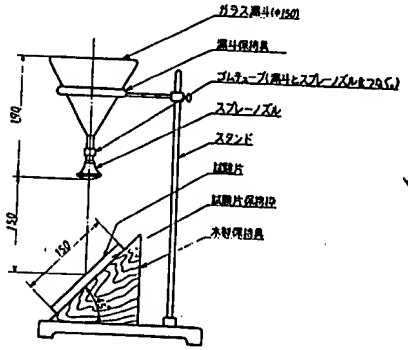
（c） 湿潤状態の比較見本　図5に示すように，湿潤状態によってその点数を定めてあるもの。

（d） 水　蒸留水又はイオン交換水を用い，試験時の温度は原則として20±2℃とするが，他の場合はそのときの温度を付記する。

（2） 操　作　3.の試料から，約20×20cmの試験片を3枚採取し，試験片保持枠にしわを生じないように取り付け(1)，図4のはっ水度試験装置を用いて，スプレーの中心を保持枠の中心に一致させ，水250mlをガラス

図 4　はっ水度試験装置

単位 mm



スプレーノズル

単位 mm

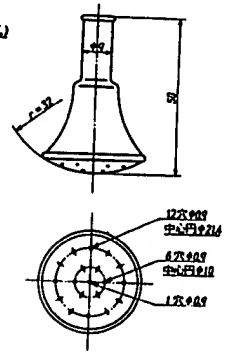
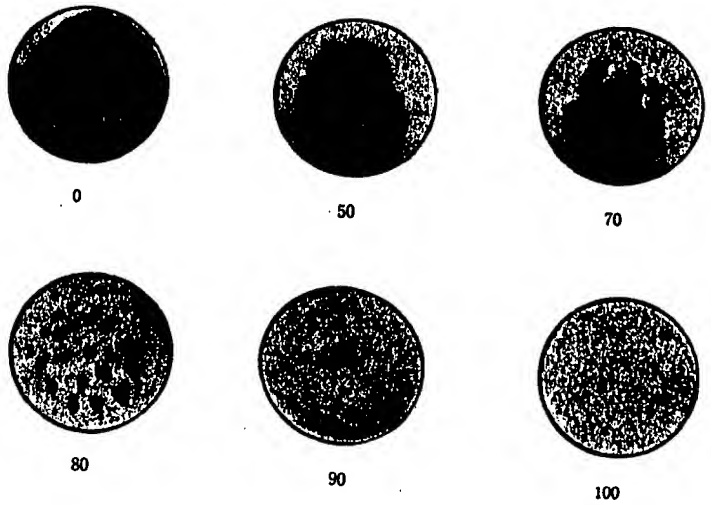


図 5　湿潤状態の比較見本



0：表面及び裏面が全体に湿潤を示すもの。

50：表面全体に湿潤を示すもの。

70：表面の半分に湿潤を示し，小さな個々の湿潤が布を浸透する状態を示すもの。

80：表面に小さな個々の水滴状の湿潤を示すもの。

90：表面に湿潤しないが，小さな水滴の付着を示すもの。

100：表面に湿潤や水滴の付着がないもの。

6.26 吸水性

6.26.1 吸水速度

（1） A 法（滴下法） 3.によって調整した試料から約20×20 cmの試験片10枚を採取し，金属製リング（直径15 cm）に取り付ける。次に，水(※59) 1 mlを25±3滴に分割できるビュレットを用い，ビュレットの先端が試験片の表面から1 cmの高さになるようにして水滴を1滴落下させ，ストップウオッチによって水滴が試験片上に達したときからその水滴が特別な反射をしなくなるまで(※60)の時間(s)を計る。試験回数は10回とし，その平均値(s)で表す（小数点以下1けたまで）。

注(※59) 水は，JIS K 0050（化学分析方法通則）に規定のものを用いる。水の温度は20±2℃とする。

また，試験片の吸水性が大きい場合は，水の代わりに50%又は65%の砂糖水を使用してもよい。この場合の補正値は50%の場合0.141，65%の場合0.023とする。

(※60) "特別な反射をしなくなった"とは，試験片が水滴を吸収するにつれて鏡面反射が消え，湿潤だけが残る状態をいう。

試験片を取り付けたリングは光源と観察者の間に置き，水滴の特別な光の反射が明らかに見える角度から観察する。

備 考 平均湿潤時間の短いほど試験片は，ぬれやすい。

（2） B 法（バイレック法） 3.によって調整した試料から20×2.5 cmの試験片をたて方向及びよこ方向にそれぞれ5枚採取し，各試験片を20±2℃の水を入れた水槽上の一定の高さに支えた水平棒上にピンで止める。試験片の下端を一線に並べて水平棒を降ろして，試験片の下端がちょうど水につかるようにする。鋼製のスケールを水平棒に試験片と一緒につるし，10分間の毛細管現象による水の上昇した高さ(mm)を測定(※61)する。試験回数はたて方向及びよこ方向それぞれ5回とし，その平均値(mm)で表す（整数位まで）。

注(※61) 毛細管現象による水の上昇が読みにくいときは，らくだのヘアーブラシに水溶性染料（エオシンなど）を付けて試験片に振り掛ける。

備 考 数値の高いほど吸水性がよい。

（3） C 法（沈降法） 3.によって調整した試料から1×1 cmの試験片を3枚採取し，20±2℃の水を入れた水槽中に試験片を浮かべ，試験片が湿潤して水中に沈降し始めるまでに要する時間(秒)(※62)を測定する。試験回数は3回とし，その平均値で表す（整数位まで）。

注(※62) 3時間以上を要するときは沈降しないものとみなす。

6.26.2 吸水率

3.によって調整した試料から7.5×7.5 cmの試験片を3枚採取し，各試験片の質量を量る(5 mgまで)。次に，図50に示すようにおもり(※63)を試験片の一端に取り付け，27±1℃の水をいれた浸せき槽中に落とし，20分間浸せきした後，2枚の乾燥したろ紙(※64)の間に挟み，2.5 cm/sの表面速度でローラ絞り機(※65)に通し，直ちに試験片の質量(mg)を量り(5 mgまで)，次の式によって吸水率を求める。試験回数は3回とし，その平均値で表す（小数点以下1けたまで）。

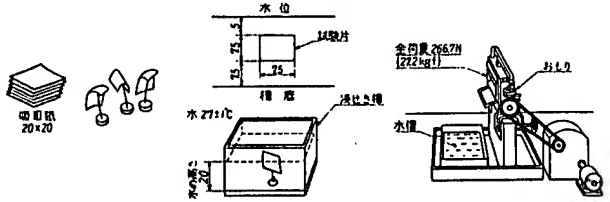
$$吸水率\ (\%) = \frac{W_1 - W}{W} \times 100$$

ここに，W：吸水前の質量(g)

W_1：吸水後の質量(g)

図 50 吸水率試験装置

単位 cm



注(※63) おもりは水槽の底に沈むのに十分なもので，沈めた試験片の上端が水面下5 cmのところに来るように水位を調整する。

(※64) ろ紙はJIS P 3801［ろ紙（化学分析用）］2種の角形ろ紙（20×20 cm）を用いる。

(※65) 絞り機のロールは，全荷重266.7 N {27.2 kgf} の均一荷重に保たれ，長さ30 cm，直径5～6.5 cmのもの。

6.27 通気性

6.27.1 A 法 図51のようなフラジール形試験機を用い，円筒の一端に適当な大きさの試験片を取り付けた後，加減抵抗器によって傾斜形気圧計が水柱1.27 cmの圧力を示すように吸い込み，吸込みファンを調整し，そのときの垂直形気圧計の示す圧力と，使用した空気孔の種類とから，試験機に附属の表によって試験片を通過する空気量 $cm^3/cm^2 \cdot s$ を求める。測定は5回とし，その平均値で表す（小数点以下1けたまで）。

6.27.2 B 法 この方法は，主として毛織物に適用する。

試料の異なる5か所から5×5 cmの試験片を採取し，図52のような空気透過度試験機の空気噴出口（口径9 mm）に試験片を差し込んで締め付け，300 mlの空気が1.39 N {141.8 gf} の荷重で織物を通して噴出されるのに要する時間を計り，所要時間（秒）で空気透過度を表す。1試験片の異なる3か所について測定し，5枚の試験片の平均値で表す（小数点以下1けたまで）。

図 51 フラジール形試験機

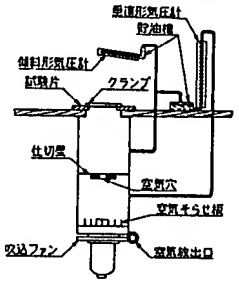
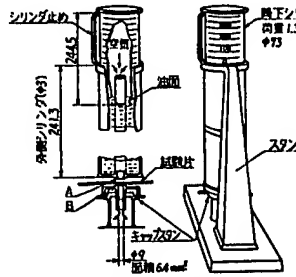


図 52

単位 mm



キャップスタンをねじ上げ，*AB* 面で試験片を締め付ける。*AB* の口径9 mm。

6.28 保温性

6.28.1 A 法（恒温法） 保温性試験機を用い，試料を恒温発熱体に取り付け，低温度の外気に向かって，流れ出す熱量が一定となり，発熱体の表面温度が一定値を示すようになってから2時間後に試験片を透過して放散される熱損失を求め，これと試験片のない裸状のままで同様の温度差及び時間に放散される熱損失とから，次の式によって保温率(%)を求める。試験結果には，外気と発熱体表面との温度差，風速及び方向などの条件を付記する（小数点以下1けたまで）。

$$保温率\ (\%) = \left(1 - \frac{b}{a}\right) \times 100$$

ここに，a：発熱体の裸状における放熱量 $[J/cm^2 \cdot s]$ {$cal/cm^2 \cdot s$ 又は W/cm^2}

b：発熱体に試料を取り付けたときの放熱量 $[J/cm^2 \cdot s]$ {$cal/cm^2 \cdot s$ 又は W/cm^2}

6.28.2 B 法（冷却法） 保温性試験機の熱源体を試料で覆い，低温気流中に放冷させ，一定時間において冷却する熱源体の温度差又は一定温度から所定の温度まで冷却するのに要する時間(min)を計り，これを裸状の場合と比較して，次の式によって保温率(%)を求める。試験結果には，試験条件を付記する（小数点以下1けたまで）。

（1） 温度差による場合

$$保温率\ (\%) = \left(1 - \frac{b}{a}\right) \times 100$$

ここに，a：熱源体の裸状における一定時間冷却後の温度差(℃)

b：熱源体に試料片を取り付けたときの一定時間冷却後の温度差(℃)

（2） 時間による場合

$$保温率\ (\%) = \left(1 - \frac{a}{b}\right) \times 100$$

ここに，a：熱源体の裸状において一定温度から所定温度に冷却するのに要する時間(min)

b：熱源体に試料片を取り付けたときの冷却に要する時間(min)

6.29 耐光性

3.によって調整した試料から，必要な大きさと枚数の試験片を採取し，耐光性試験機を用いて所定の時間照射した後，試験片を取り出して標準状態とする。この試験片につき必要に応じて引張強さ，防水性，色の変化などの試験を行う。

例えば，引張強さ保持率は，次の式によって求める。

$$引張強さ保持率\ (\%)=\frac{G_1}{G}\times 100$$

ここに，G：照射前の引張強さ (N {kgf})

G_1：照射後の引張強さ (N {kgf})

また，色の変化の判定は，原則として JIS L 0804 (変退色用グレースケール) を用いて行う。

耐光性試験機は，カーボンアーク灯形又はキセノンアーク灯形を用いることとし，試験条件は JIS L 0842 (カーボンアーク灯光に対する染色堅ろう度試験方法) 又は JIS L 0843 (キセノンアーク灯光に対する染色堅ろう度試験方法) による。

6.30 耐候性

6.30.1 A 法 試料から，必要な大きさと枚数の試験片を採取し，JIS B 7752 (紫外線カーボンアーク燈式耐候性試験機) 又は JIS B 7753 (サンシャインカーボンアーク灯式耐候性試験機) に規定する試験機を用いて，所定の時間暴露した後試験片を取り出して自然乾燥し，標準状態で調湿する。調湿後の試験片につき必要に応じて引張強さ (N)，防水性，色の変化などの試験を行う。例えば，引張強さ保持率は，次の式によって求める。

$$引張強さ保持率\ (\%)=\frac{G_1}{G}\times 100$$

ここに，G：暴露前の引張強さ (mN {gf})

G_1：暴露後の引張強さ (mN {gf})

また，色の変化の判定は，原則として JIS L 0804 に規定するグレースケールを用いて行う。耐候性試験機の試験条件は次のとおりとし，その他は試験結果に付記するものとする。

(1) ブラックパネル温度 63±3℃

(2) ドラムの回転数 1 rpm

(3) スプレー圧力とノズル数 78.5～127 kPa {0.8～1.3 kgf/cm²} で 4 個

(4) 噴霧時間 120 分間ごとに 18 分間噴霧する。

(5) 噴霧水量 75.7～113.6 l/h

(6) 降雨に用いる水 試験片を汚染しない清浄な水で pH は 6.0～8.0 とする。

(7) 暴露時 (スプレーがないとき) の湿度 65±5% RH

(8) 光フィルターは白濁又は着色状態で使用してはならない。

(9) 使用時間が 2 000 時間を超えたフィルターは使用してはならない。

付記事項

(1) 使用機械名及びアークランプの形状

(2) 灯数

(3) 平均放電電圧及び電流

(4) 暴露時間

6.30.2 B 法 この方法は，主として毛織物に適用する。

試料から，任意の大きさの試験片を採取し，木枠に取り付け，木枠を水平面に 45°の角度で屋上又は影のない場所で南面にして置き，原則として 20 日間継続して露出し，日光と風雨にさらす。試験前後の変退色を比較して色の変化を判定する。

標準見本のある場合には，試料と標準見本との両者から試験片を切り取り同時に試験を行い，ときどき両者を比較して試料の試験片の変退色が標準見本の試験片の変退色より少ない場合には 20 日間以内に試験を中止してもよい。

6.31 防虫性 この方法は，毛織物に適用する。

防虫加工織物及びできるだけ同一条件の無処理織物から，直径 3～4 cm の試験片をそれぞれ 4 枚ずつ採取し，それぞれの絶乾質量 (mg) を量り，それぞれ平均値を求める。防虫加工試験片 4 枚及び無処理試験片 4 枚を別々に直径 4～5 cm のすず製の容器又は同形のペトリ皿に入れ，これに害虫の幼虫 (**) 25 匹ずつを入れて標準状態の試験室内の暗所に 14 日間放置する。14 日間経過後，二つの生き残った虫の数 n，n' を数え，幼虫が排せつしたふんを羽根ぼうきで試験片から集めてひょう量し，それぞれ w，w' とする。

次に，試験片の各々の絶乾質量 (mg) を量り，それぞれの平均値を求める。

虫害による織物の減量 (mg) は，次の式によって求める。

$$G_1\ (\mathrm{mg})=w_1-w_2$$

ここに，G_1：防虫加工織物の減量 (mg)

w_1：試験前の防虫加工織物試験片 4 枚の絶乾質量平均値 (mg)

w_2：試験後の防虫加工織物試験片 4 枚の絶乾質量平均値 (mg)

$$G_2\ (\mathrm{mg})=w_1'-w_2'$$

ここに，G_2：無処理織物の減量 (mg)

w_1'：試験前の無処理織物試験片 4 枚の絶乾質量平均値 (mg)

w_2'：試験後の無処理織物試験片 4 枚の絶乾質量平均値 (mg)

防虫加工織物の防虫効力 (%) は，次の式によって求める。

$$防虫加工織物の防虫効力\ (\%)=\frac{G_2-G_1}{G_2}\times 100$$

注 (**) 害虫の幼虫はあらかじめ羊毛物質で飼育したものを用い，体長及び活動力のそろったものを選んで試験する。

備考 防虫加工剤の殺虫効力 (%) は，次の式によって推定できる。

$$殺虫効力\ (\%)=\frac{n'-n}{n'}\times 100$$

ここに，n：防虫加工織物片を入れたペトリ皿中で生き残った虫の数

n'：無処理加工織物片を入れたペトリ皿中で生き残った虫の数

試験中の害虫の活動力の強弱は，排せつしたふん量 w，w' の比率から推定できる。

6.32 摩擦変色度

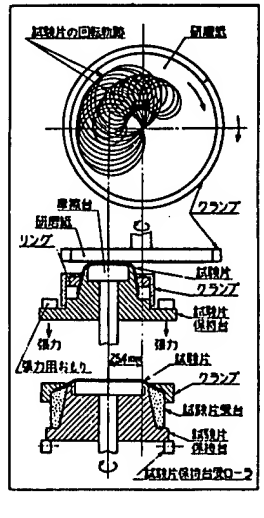
6.32.1 A 法 (ユニホーム形法) 3. によって調整した試料から直径 10.0 cm の円形試験片を 3 枚採取し，図 53 のようなユニホーム形摩耗試験機を用い，摩擦面が直径 5 cm の試料取付台に織物の表面を上にして取り付ける。次に，摩擦子にはスプリングスチールブレードを用い 4.45 N {0.454 kgf} の押圧荷重で試験片を多方向に 100 回摩擦する。次いで，試験片を取り出し摩擦面と摩擦しない面の間に見える色の開きと，変退色用グレースケール (**) の各色票間に見える色の開きを比較して判定 (**)，3 回の平均値で表す。ただし，摩耗試験機のスプリングスチールブレードの回転数は約 64 rpm，試料取付台の回転数は 62 rpm とし，摩擦子がスプリングスチールブレードによらないときは付記する。

注 (**) 変退色用グレースケールは，JIS L 0804 による。

(**) 判定は，JIS L 0801 (染色堅ろう度試験方法通則) による。

6.32.2 B 法 (ユニバーサル形法) 3. によって調整した試料から 2.5×20 cm の試験片を採取し，ユニバーサル形屈曲摩耗試験機を用いて織物の裏側がバーと摩擦されるように折り畳み，押圧荷重 2.23 N {0.227 kgf}，引張荷重 4.45 N {0.454 kgf} を加えて 2.5 cm 間の距離を 100 回往復摩擦する。次に，試験片を取り出し摩擦面と摩擦しない面の間に見える色の開きと，変退色用グレースケール (**) の各色票間に見える色の開きを比較して判定する。

図 53 ユニホーム形摩耗試験機の構造



6.32.3 C 法 (テーパ形法) 3. によって調整した試料から，直径 13 cm の円形試験片を採取し，図 17 のようなテーパ形摩耗試験機を用い，織物の表側を上にして試料ホルダのゴムマット上に取り付ける。次に，摩耗輪 (**) を試験片の上に載せて押圧荷重 2.49 N {0.245 kgf} で 100 回摩擦する。次いで，試験片を取り出し摩擦面と摩擦しない面の間に見える色の開きと，変退色用グレースケールの各色票間に見える色の開きとを比較して判定する。

注 (**) 摩耗輪は，SC-10 を用いる。

6.32.4 D 法 (マーチンデール法) この方法は，主として毛織物に適用する。

6.17.5 の E 法によって試験を行い，変退色が変退色用グレースケールの 3 号になったときの摩擦回数で表す。

6.33 のり分 試料の異なった 2 か所 (1) からそれぞれ 2 g ずつ試験片を採取し，その絶乾質量 (g) を量り，次のいずれかの方法でのり抜きを行った後，再び絶乾質量 (g) を量り，次の式によってのり分 (%) を求め，その平均値で表す (小数点以下 1 けたまで)。

$$のり分\ (\%)=\frac{W-W'}{W'}\times 100$$

ここに，W：のり抜き前の絶乾質量 (g)

W'：のり抜き後の絶乾質量 (g)

(1) A 法 (希塩酸法) 試験片をビーカに入れ，水中で 10 分間煮沸後 0.25% 塩酸 (**) (浴比 100：1) 中で，更に 30 分間煮沸した後，温水で十分に洗浄する。

注 (**) 0.25%塩酸の調製 JIS K 8180 [塩酸 (試薬)] の特級 (比重 1.18～1.19) 7 g を水に溶かして 1 l とする。

Exhibit C

繊維製品の透湿度試験方法　L 1099-1985

Testing Methods for Water Vapour Permeability of Clothes

1. **適用範囲**　この規格は，繊維製品の透湿度 (1) の試験方法について規定する。

注 (1)　透湿度とは，規定の温度及び湿度において繊維製品を通過する水蒸気の質量 (g) を，その繊維製品 1 m²・1 時間当たりに換算した値とする。

2. **試験の種類**　この試験には，次の 3 種類があって，それぞれ独立した別個の試験方法である。試験する場合には，これらのうちから適当な方法を選んで行う。

(1)　A　法
(a)　A−1 法 (塩化カルシウム法)
(b)　A−2 法 (ウォーター法)
(2)　B　法 (酢酸カリウム法)

3. **試料の採取**　試料は原則として，織物の場合は両耳端から全幅の $\frac{1}{10}$ ずつ，端末から 1 m 以上除いた部分から，編物の場合は端末から 50 cm 以上，耳のあるものは耳端から 10 cm 以上離れた部分から試料を採取する。

4. **試験方法**

4.1　A　法

4.1.1　A−1 法 (塩化カルシウム法)

(1)　**装置及び材料**　装置及び材料は，次のものを用いる。

(a)　**恒温恒湿装置**　規定の温度及び湿度に保たれた空気が風速約 0.5 m/s (2) で循環できるもの。

注 (2)　風速約 0.5 m/s とは，風の吹き出し口の中心部から，約 10 cm 離れた位置で測定したとき，風速が 0.3～1.0 m/s の範囲であること。

(b)　**化学はかり**　試験体の質量を 1 mg までひょう量できるもの。

(c)　**透湿カップ**　原則として図 1 に示すものとし，その材質は水蒸気が不透過性のものであって，かつ，試験条件において腐食したり，透湿面積の変化を生じたりしないもの。

(d)　**吸湿剤**　JIS K 8125 [塩化カルシウム (水分測定用) (試薬)] に規定のもの。

(2)　**操作**　3. の試料から，直径約 7 cm の円形試験片を，3 枚採取する。あらかじめ約 40℃ に温めた透湿カップに吸湿剤を同カップの上端から約 3 mm の位置まで入れる。次いで，図 1 のように試験片の表面を吸湿剤側に向けて透湿カップに対して同心円になるように載せ，パッキン及びリングを順次装着し，ちょうナットで固定する。更に，装着側面をビニル粘着テープでシールして試験体とする。この試験体を温度 40±2℃，湿度 90±5% RH の空気が循環する恒温恒湿装置に入れ，1 時間後に試験体を取り出し直ちに質量 a_1 (mg) を測定する。次に，この試験体を再び恒温恒湿装置に入れ，1 時間後に試験体を取り出し直ちに質量 a_2 (mg) を測定する。

(3)　**算出**　次の式で透湿度を求め，3 回の平均値で表す (整数位まで)。

$$P=\frac{10\times(a_2-a_1)}{S}$$

ここに，P：透湿度 [g/(m²·h)]
S：透湿面積 (cm²)

4.1.2　A-2 法 (ウォーター法)

(1)　**装置及び材料**　装置及び材料は，次のものを用いる。

(a)　**恒温恒湿装置**　4.1.1 (1) に規定のもの。

(b)　**化学はかり**　4.1.1 (1) に規定のもの。

(c)　**透湿カップ**　原則として図 2 に示すものとし，その材質は水蒸気が不透過性のものであって，かつ，試験条件において腐食したり，透湿面積の変化を生じたりしないもの。

(2)　**操作**　3. の試料から，直径約 8 cm の円形試験片を，3 枚採取する。あらかじめ約 40℃ に温めた透湿カップに約 40℃ の水 (3) を同カップの上端から約 10 mm の位置まで入れる。次いで，図 2 のように試験片の裏面を水側に向けて透湿カップに対して同心円になるように載せ，パッキン及びリングを順次装着し，ちょうナットで固定する。更に，装着側面をビニル粘着テープでシールして試験体とする。この試験体を温度 40±2℃，湿度 50±5% RH の空気が循環する恒温恒湿装置に入れ，1 時間後に試験体を取り出し直ちに質量 a_1 (mg) を測定する。次に，この試験体を再び恒温恒湿装置に入れ，1 時

図 1　透湿カップ (A−1 法)

単位 mm

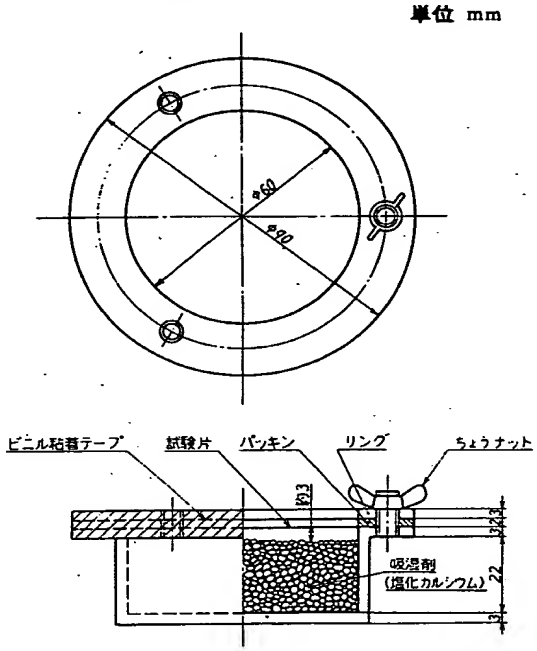
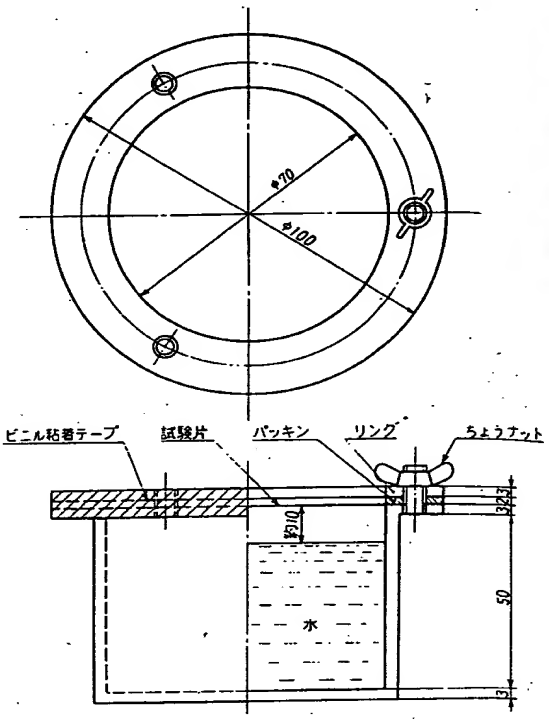


図 2　透湿カップ (A−2) 法

単位 mm



間後に試験体を取り出し直ちに質量 a_2 (mg) を測定する。

なお，試験片を透湿カップ内の水でぬらさないよう，試験体の扱いには十分な注意が必要である。

注 (3)　蒸留水又は イオン交換水

(3)　**算　出**　次の式で透湿度を求め，3 回の平均値で表す (整数位まで)。

$$P=\frac{10\times(a_1-a_2)}{S}$$

ここに，P：透湿度 [g/(m²·h)]

S：透湿面積 (cm²)

4.2　**B　法 (酢酸カリウム法)**

(1)　**装置及び材料**　装置及び材料は，次のものを用いる。

(a)　**恒温装置**　規定の温度に調節できるもの。

(b)　**化学はかり**　4.1.1 (1) に規定するもの。

(c)　**透湿カップ**　原則として図 3 に示すものとし，その材質は水蒸気が不透過性のものであって，かつ，試験条件において腐食したり，透湿面積の変化を生じたりしないもの。

(d)　**試験片支持枠**　内径 約 80 mm，高さ 約 50 mm，厚さ 約 3 mm の合成樹脂製の円筒形のもの。

(e)　**水　槽**　恒温装置に収納でき，試験片支持枠を固定できる構造をもつもの。

(f)　**透湿度測定用補助フィルム**　空孔率 (4) 約 80% の微多孔質構造をもつ，厚さ約 25 μm のポリテトラフロロエチレンフィルム。

注 (4)　空孔率とは，体積に対する空間の割合をいう。

(g)　**吸 湿 剤**　JIS K 8363 [酢酸カリウム (試薬)] に規定のもの。

(2)　**操　作**　3. の試料から，約 20×20 cm の大きさの試験片を，3 枚採取する。温度 約 23℃ の水の入った水槽を温度 30±2℃ の空気が循環する恒温装置中に置く。図 3 のように試験片を試験片支持枠に試験片の裏面が支持枠の外側に向くようにゴム製バンドで装着し，この試験片支持枠を恒温装置中の水槽に水に浮かせるように固定する。次に，透湿カップに温度 約 23℃ に保った酢酸カリウム溶液 (5) を透湿カップ容積の 約 $\frac{2}{3}$ 入れ，透湿度測定用補助フィルムをゴム製バンドで装着して試験体とする。この試験体の質量 a_0 (mg) をフィルム装着側を上にして測定した後，直ちに試験体を倒立させて試験片支持枠の中に入れる。15 分後に試験体を取り出し，反転させて質量 a_1 (mg) を測定する。

注 (5)　水 100 ml に対して酢酸カリウム 300g を加え一昼夜放置して，結晶が析出した状態のもの。

(3)　**算　出**　次の式で透湿度を求め，3 回の平均値で表す (整数位まで)。

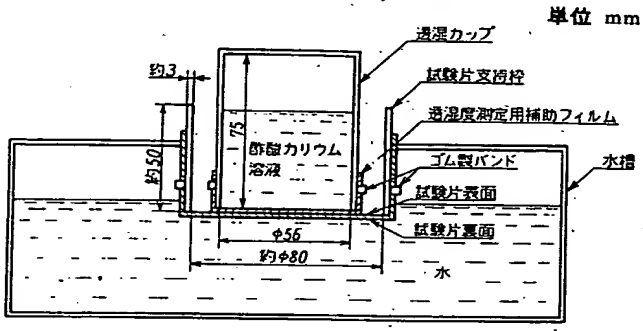
$$P=\frac{40\times(a_1-a_0)}{S}$$

ここに，P：透湿度 [g/(m²·h)]

S：透湿面積 (cm²)

図 3　透湿カップ (B 法)

単位 mm



備 考　この試験方法は，試験時において，水が浸透する試料には適用できない。

5. **試験記録**　試験記録には，試験の種類及び平均値を記載し，特に試験片をあらかじめ前処理した場合は，その詳細を付記する。

例 1：A−1 法　200 g/(m²·h)

例 2：B 法　1000 g/(m²·h)　JIS L 0217 の 103 の操作を 3 回繰り返す。

◆解説抜粋◆

2. **試験の種類**　試験方法は，3 種類を規定した。これらは，いずれも透湿カップを用いて透湿度を測定する方法であるが，透湿カップ内に抵抗体としての空気層をもち，衣類の通常の着用状態に近い透湿度を測定する A 法と，透湿カップ内に空気層をもたず，対象試料の最大透湿能力を測定する B 法に大別した。

各試験方法を用いるに当たっては，それぞれの特徴を参考にされたい。

(1) A 法

(a) A-1 法(塩化カルシウム法)　この試験方法は，透湿カップ内に空気層をもたせ，試験片を境界として，透湿カップ内側を塩化カルシウムで乾燥状態にし，透湿カップ外側を多湿状態として，この間に生じる蒸気圧差により強制的に水蒸気を吸湿させ，その透過量を測定し，透湿度を評価するものである。

したがって，この試験方法は，衣服内が多湿状態となる着用条件下での透湿度測定に適し，透湿・防水素材をはじめあらゆる繊維素材に適用できる。

(b) A-2 法(ウォーター法)　この試験方法は，透湿カップ内に空気層をもたせ，試験片を境界として，透湿カップ内に水を入れ多湿状態に，透湿カップ外側を恒温恒湿 (40℃，50% RH) 状態として，この間に生じる蒸気圧差により水蒸気を自然蒸発させ，その透過量を測定し，透湿度を評価するものである。

したがって，この試験方法は，衣服内が多湿状態となる着用条件下で，通常の外気環境下での透湿度測定に適し，透湿防水素材をはじめあらゆる繊維素材に適用できる。

なお，この試験方法は，透湿カップ内水温を一定にしながら外気環境を各種条件に変化させた場合の透湿度測定に応用できる。

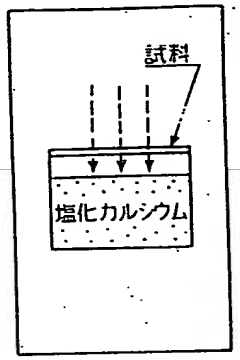
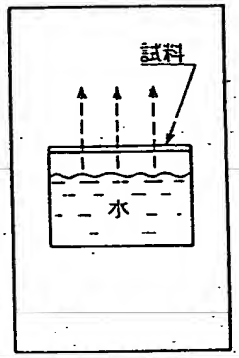
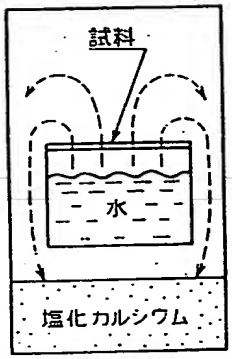
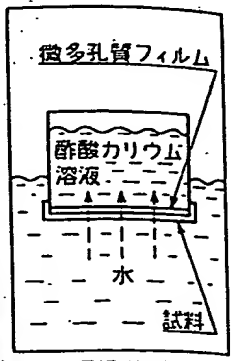
(2) B 法(酢酸カリウム法)　この試験方法は，透湿カップ内に酢酸カリウム溶液を入れた透湿カップを倒立させ試験片上に置き，試験片を水に浸し，微多孔質フィルムを介して酢酸カリウム溶液に水蒸気を吸湿させ，その透湿量を測定し透湿度を評価するものである。

この試験方法は，試験片を水に浸すことから，ある程度以上の防水性能を有する試料にだけ適用できるものである。現在，この試験方法に採用できる防水性能基準は，数値で決定するまでに至っていないので，本体の備考に記す方法で適用の可否を判断されたい。

4. **ISO 規格との整合性について**　本規格に関係する ISO 規格としては，ISO 2528 がある。

この ISO 規格は，透湿カップに吸湿剤として塩化カルシウムを入れ，これを恒温恒湿装置内に入れる方法で，本規格の A-1 法と類似した試験方法であるが，繊維だけでなく，厚さ 3 mm 以下の紙，板，プラスチック等いかなる

解説表 1　試験方法の分類

名　称	塩化カルシウム法	ウォーター法	(デシケータ法)	酢酸カリウム法
原　理	 恒温恒湿装置	 恒温恒湿装置	 恒温装置	 恒温装置
特　徴	透湿カップ内に空気層がある。			透湿カップ内に空気層がない。
	蒸気源は恒温恒湿装置。	蒸気源は透湿カップ内の水。		蒸気源は水槽の水。
	透湿カップ内に吸湿剤を用いる。	吸湿剤を用いない。	透湿カップ外に吸湿剤を用いる。	透湿カップ内に吸湿剤(液体)を用いる。
該当試験方法	JIS L 1099 の A-1法 JIS K 6549 JIS Z 0208 ISO 2528 ASTM E 96 の Desiccant Method	JIS L 1099 の A-2法 ASTM E 96 の Water Method	JIS K 6328 (ゴム引布) の参考試験方法 JIS Z 1504 (しわ付き防水紙)	JIS L 1099 の B法
		JIS L 1096 (一般織物試験方法) の参考試験方法 JIS L 1018 (メリヤス生地試験方法) の参考試験方法		

シート状材料も対象としているため，解説表 2 のとおり多くの相異点がある。
なお，JIS Z 0208 は，この ISO 規格とほぼ整合している。

解説表 2　ISO 規格と本規格との相異点

項　目	ISO 2528	JIS L 1099 の A-1法
対象試料	シート状材料 (厚さ 3 mm以下)	繊維製品
測定間隔	24 時間，48 時間 又は 96 時間 ただし，高透湿性のものは 3 時間，4 時間 又は 8 時間	1時間
シール方法	ワックスによるシール	ちょうナット固定シール
単位時間	24時間	1時間
試験条件	A：25±0.5℃，90±2% RH B：38±0.5℃，90±2% RH C：25±0.5℃，75±2% RH	40±2℃ 90±5% RH